

The impacts of amniotic fluid index, placental localization and fetal sex on the estimation of fetal weight

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Abstract

Objective: In our study, we aimed to investigate the impacts of amniotic fluid index, placental localization and fetal sex on the estimation of fetal weight by ultrasonographic method.

Methods: The medical files of the patients who delivered between September 1 and December 31, 2016 in Department of Obstetrics and Gynecology, Faculty of Medicine, Selçuk University were reviewed retrospectively after obtaining the approval of ethics committee. The patients with birth weight less than 2500 g and higher than 4500 g, patients with fetal intrauterine development, diabetes and additional diseases, multiple pregnancies, the deliveries with intrauterine death or fetuses with anomalies, the patients whose cervical dilation was ≥ 4 cm during admission, and the patients with maternal body mass index (BMI) ≥ 25 were excluded from the study. The maximum duration from the ultrasonographic examination up to delivery of the patients was determined 72 hours, and the patients who delivered more than this duration were also excluded from the study. The data were compared according to fetal sex, anterior, posterior and lateral placental localizations, and oligohydramnios, polyhydramnios and normal values in the amniotic fluid index. The statistical analysis was carried out by SPSS 22.0 (SPSS Inc., Chicago, IL, USA). Kruskal-Wallis H and Student's t-tests were used for the data analysis.

Results: We evaluated a total of 387 patients. The mean age was 28, the cesarean section rate was 39.8%, normal delivery rate was 60.2%, mean ultrasonographic birth weight was 3319 g (± 413 g), and mean birth weight was 3330 g (± 376 g). Weight deficit was calculated as 7.2% in all patients. No statistically significant difference was observed between the groups in terms of fetal sex, placental localization and amniotic fluid index.

Conclusion: We found in our study that the amniotic fluid index, placental localization and fetal sex do not have a determining role on the estimation of fetal weight.

Keywords: Estimated fetal weight, placenta, sex, amniotic fluid index.

Özet: Amniyotik sıvı indeksi, plasenta lokalizasyonu ve fetal cinsiyetin fetal ağırlık tahmini üzerine etkisi

Amaç: Çalışmamızda amniyotik sıvı miktarı, plasenta lokalizasyonu ve fetal cinsiyetin ultrasonografik yöntemle fetal ağırlık tahmini üzerine etkisini incelemeyi amaçladık.

Yöntem: Selçuk Üniversitesi Tıp Fakültesi Kadın Hastalıkları ve Doğum Kliniğinde 1 Eylül – 31 Aralık 2016 tarihleri arasında doğum yapmış hastaların dosyaları etik kurul onayı sonrası retrospektif olarak incelendi. Doğum ağırlığı 2500 gramdan düşük ve 4500 gramdan büyük olan hastalar, fetal intrauterin gelişme geriliği, diyabeti ve ek hastalığı olan hastalar, çoğul gebelikler, intrauterin ölü veya anomalili fetüs doğumları başvuru esnasında servikal açıklığı ≥ 4 cm olan hastalar ve maternal vücut kitle indeksi (VKİ) ≥ 25 olan hastalar çalışma dışında bırakıldı. Hastaların ultrasonografi muayenesinden doğuma kadar olan maksimum süre 72 saat olarak belirlendi ve daha geç sürede doğum yapan hastalar da çalışma dışında bırakıldı. Veriler fetal cinsiyete göre, plasentanın anterior, posterior, lateral lokalizasyonuna ve amniyotik sıvı indeksinde oligohidramniyoz, polihidramniyoz ve normal değerlerine göre kıyaslandı. İstatistik analiz için SPSS 22.0 (SPSS Inc., Chicago, IL, ABD) kullanıldı. Veri analizi için Kruskal-Wallis H ve Student t testi kullanıldı.

Bulgular: Toplam 387 hasta incelendi. Ortalama yaş 28 olup, hastalarda sezaryen oranı %39.8, normal doğum oranı ise %60.2, ortalama ultrasonografik doğum ağırlığı 3319 g (± 413 g), ortalama doğum ağırlığı 3330 g (± 376 g) olarak saptandı. Bütün hastalarda kilo defisiti %7.2 olarak hesaplandı. Fetal cinsiyet, plasenta lokalizasyonu ve amniyotik sıvı indeksine göre gruplar arasında istatistiksel olarak anlamlı bir fark izlenmedi.

Sonuç: Çalışmamızda amniyotik sıvı indeksi, plasenta lokalizasyonu ve fetal cinsiyetin tahmini fetal ağırlık üzerinde belirleyici olmadığı bulunmuştur.

Anahtar sözcükler: Tahmini fetal ağırlık, plasenta, cinsiyet, amniyotik sıvı indeksi.

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Introduction

The follow-up of the fetal growth is a standard element of antenatal care. Many formulas have been developed to estimate fetal weight especially at the end of second trimester and at the third trimester. In these formulas, biometric measurements obtained by fetal ultrasonography are used. The fetal weight estimated by these biometric measurements is compared to the estimated weight which needs to be in the regarding week of baby. The follow-up of intrauterine fetal growth has reached a significant position in the obstetric follow-up today. In the formulas used for estimating fetal weight, biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) measurements are used frequently. While Warsof, Shepard and Hadlock formulas are the most common ones, more than 30 formulas have been reported.^[1-4] Most of them are preset formulas in the ultrasonography devices today. There are many studies on the formulas and each formula has a different margin of error.^[5,6] In addition to the difference among the formulas, there are also various factors affecting the estimation of fetal weight. Ethnicity, operator's experience, conditions affecting image quality (oligohydramnios, multiple pregnancy, maternal obesity, and fetal position etc.), changes in fetal body composition, gestational age, fetal anomaly, growth retardation, macrosomia and fetal sex are among these factors.^[5-12]

In our study, we aimed to assess the impacts of amniotic fluid amount and fetal sex, the activities of which are controversial, and placental localization, the activity of which is unknown, on the estimation of fetal weight by ultrasonographic methods.

Methods

The medical files of the patients who delivered between September 1 and December 31, 2016 in Department of Obstetrics and Gynecology, Faculty of Medicine, Selçuk University were reviewed retrospectively after obtaining the approval of ethics committee. The patients with birth weight less than 2500 g and higher than 4500 g, patients with intrauterine development, diabetes and additional diseases, multiple pregnancies, the deliveries with intrauterine death or fetuses with anomalies, the patients whose cervical dilation was ≥ 4 cm during admission, and the patients with maternal body mass index (BMI) ≥ 25 were excluded from the study. The maximum

duration from the ultrasonographic examination up to delivery of the patients was determined 72 hours, and the patients who delivered more than this duration were also excluded from the study.

The ultrasonographic examinations of the patients were performed by senior physician assistant or senior physician using the same ultrasonography device (GE Medical Systems, Zipf, Austria). In the biometric measurements, BPD, HC, ACL and FL were checked as a standard procedure. The calculation was done by using Hadlock (BPD, HC, AC, FL) formula recorded in the ultrasonography device. Amniotic fluid index (AFI) was measured on four quadrants through maximum vertical pocket which is not extremity and cord. In our study, 50–240 mm was considered the normal limits for AFI. It was considered oligohydramnios when AFI was measured 49 mm and below, and polyhydramnios when AFI was measured 240 mm and above. We established three groups in our study, which were oligohydramnios, normal AFI and polyhydramnios. We calculated percent error of ultrasonography when estimating birth weight, and defined it as deficit percentage. The weight deficit percentage was equal to $(\text{birth weight} - \text{ultrasonographic weight estimation}) / \text{birth weight} \times 100$. According to the placental localization where placenta adheres to internal wall of uterine, we established three groups, which were anterior, lateral and posterior localizations. We defined the anterior localization as placenta which adheres to internal surface of anterior uterine, the lateral localization as placenta which adheres to fundal, cervical and right and left lateral internal wall of uterine, and posterior localization as placenta which adheres to posterior wall of uterine. We compared the results of weight deficit percentage in fetal sex placental localization and amniotic fluid index groups. The statistical analysis was carried out by SPSS 22.0 (SPSS Inc., Chicago, IL, USA). Kruskal-Wallis H and Student's t-tests were used for the data analysis.

Results

We evaluated a total of 387 patients. Mean age was 28, and it ranged between 16 and 42 years. Gravida median value was found 2, parity median value was found 1 and gestational week was calculated 38 weeks. In the patients, the cesarean section rate was 39.8%, normal delivery rate was 60.2%, mean ultrasonographic birth

Table 1. Demographic and clinical data of the patients.

Variables	Data
Age*	28 (16–42)
Gravida [†]	2 (1–8)
Parity [†]	1 (0–5)
Week of gestation*	38 (33–42)
Cesarean section [†]	154 (39.8%)
Normal delivery [†]	233 (60.2%)
Ultrasonographic estimated weight [§]	3319 g (±413 g)
Birth weight [§]	3330 g (±376 g)

*mean (minimum–maximum), [†]median (minimum–maximum), [‡]n (%), [§]mean (±standard deviation).

weight was 3319 g (±413 g), and mean birth weight was 3330 g (±376 g). The demographic and clinical data of the patients are shown in the **Table 1**.

Oligohydramnios group included 29 patients, normal AFI group included 343 patients and polyhydramnios group included 15 patients. The highest weight deficit percentage was observed in the polyhydramnios group, but there was no statistically significant difference among the groups. Total weight deficit in all patients was 7.2%. While the deficit was 6.75% in females, it was 7.59% in males. In terms of deficit percentages, we observed no significant difference between two sex groups. Considering the weight deficit according to the placental localization, there was no significant difference between the groups. The comparison of weight deficit percentages according to amniotic fluid index, sex and placental localization is shown in **Table 2**.

Table 2. Comparison of weight deficit percentage according to amniotic fluid index, fetal sex and placental localization.

Variables		n (Weight deficit percentage)*	p
Amniotic fluid index	Oligohydramnios	29 (5.8)	0.225
	Normal AFI	343 (7.2)	
	Polyhydramnios	15 (9.4)	
Sex	Female	171 (6.75)	0.646
	Male	216 (7.59)	
Placental localization	Anterior placental localization	254 (7.3)	0.635
	Lateral placental localization	75 (6.8)	
	Posterior placental localization	58 (7.2)	
Total		387 (7/2)	

*n: Patient number in the group, the weight deficit percentage was equal to (birth weight - ultrasonographic weight estimation) / birth weight × 100.

Discussion

Estimating the fetal weight accurately during intrauterine period is important for antenatal care and follow-up. Knowing the growth during intrauterine period helps to manage many matters from intrauterine follow-up method up to delivery type. The problems about fetal growth are usually associated with increased morbidity. Estimating the birth weight of underweight (<1000 g) babies is important for intrauterine fetal follow-up and deciding delivery, and estimating the birth weight of overweight babies is important for deciding delivery type.^[5,13]

Many formulas have been suggested for calculating the fetal weight. In these formulas, many fetal body components were used. HC and gestational age were calculated as primary affecting factor.^[4,14] The margin of error has been reported less than 7% in very few of these formulas.^[5] In our study, we found total margin of error as 7.2%.

In their prospective study, Scioscia et al. compared the estimated and actual birth weights of 441 patients from almost same ethnicity who delivered within 48 hours after ultrasonography by using 35 different formulas. While 29 formulas had 10% or less margin of error, 69.2% of actual weight was estimated when margin of error was considered 10% in all formulas, and 86.5% of actual weight was estimated when the margin of error was considered ±15%. High accuracy rate and low variability was found in 20 formulas. They found low margin of error (about 8%) in methods using fetal head, femur and abdominal circumferences.^[15] In a retrospective analysis performed by Sabbagha et al., 23 different models were compared in the estimation of fetal weight, and Hadlock formula using fetal head, abdominal and femur was found as the formula which had the lowest margin of error.^[6] We used Hadlock formula in our study.

Seimer et al. carried out a study for the impact of fetal sex on the estimation of birth weight and investigated 3254 singleton pregnancies with weights between 2501 and 3999 g, and they found that performing sex-based investigation for the accurate estimation had the most accurate result compared to all society screening.^[8] In the retrospective study of Melamed et al., the authors found more accurate sex-based weight estimations in male fetuses. In our study, we observed no statistical difference between the sexes in terms of weight deficit; however, we calculated lower margin of error in female babies (6.75 vs. 7.59).

Amniotic fluid is especially necessary for fetal anatomic evaluation during ultrasonographic examination. The impact of amniotic fluid on fetal weight estimation ultrasonographically is controversial. While it was found in some studies that amniotic fluid amount has no impact on the estimation of fetal weight, some studies found that oligohydramnios has an adverse effect on the estimation of fetal weight.^[16–19] We found in our study that amniotic fluid measurements had no impact on estimated fetal weight.

Although there are studies in the literature on the estimated birth weight according to the placenta volume, there is no study in the literature investigating the impact of placental localization on estimated fetal weight.^[20] It has been considered theoretically that placental localization may be determinant in the weight estimation, but we found no impact of placental localization on the estimation of weight in our study.

Our study being retrospective, performance of ultrasonographic examinations by different individuals, and low number of patients are the limitations of our study.

Conclusion

Estimated fetal weight is an active parameter used in all stages of pregnancy from intrauterine follow-up up to delivery. We found in our study that the amniotic fluid index, placental localization and fetal sex do not have a determining role on the estimation of weight.

Conflicts of Interest: No conflicts declared.

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