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Investigation of the Association of Abdominal Circumference Discord-ance and Estimated Fetal Weight Discordance in Twins with Birth Weight Discordance

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Abstract

Background: Twin pregnancy is associated with a high risk of mortality and morbidity. It is necessary to estimate the weight difference of the fetuses with a reliable method to prevent possible complications. This study was conducted to compare the association between the Estimated fetal weight (EFW) discord-ance and the Abdominal Circumference (AC) discordance with birth weight in twins.

Methods: This was a descriptive-analytical and retrospective study. The statistical population was all twin pregnant mothers referred to Imam Khomeini Hospital in Ahvaz from 2017 to 2019. The sample size was determined with a census (540 people). Based on AC , the size of head circumference (HC), femur length (FL), and the Biparietal Diameter (BPD), EFW was calculated. Then the EFW Dis-cordance and AC Discordance were calculated and compared with the birth weight. Data were analyzed using SPSS18. Unpaired, Two-Tailed T-test and Pearson correlation test were used.

Results: The results showed that the mean discordance of fetal weight in twin pregnancies in the EFW method was 9.25%, in the AC method was 9.89% and finally, at birth, was 10.72%. The correla-tion of the weight difference between the two embryos in the AC method with the time of birth ($r = 0.922$ and $P < 0.001$) was higher than in the EFW method with the time of birth ($r = 0.69$ and $P < 0.001$) and finally, it was found that in detecting the discordance more than 20% and 25%, AC diagnostic power was good, but EFW was moderate.

Conclusion: Therefore, to evaluate the weight and weight difference in twin embryos, the AC method has the appropriate accuracy and compatibility. Another major prospective study to evaluate the diagnostic performance of AC and EFW mismatch based on gestational age at scan, incision point, and maternal and placental characteristics to determine true ultrasound diagnostic accuracy in predict-ing growth mismatch in twin pregnancy and optimal post-case management option is needed.

Keywords: Abdominal circumference discordance, Estimated Fetal Weights, twins, birth weight

Conflicts of Interest: *None declared*
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Introduction

Dizygotic twinning is much more common than monozygotic splitting of a single oocyte, and its incidence

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↑What is "already known" in this topic:
Multifetal gestations remain problematic for both the mother and her fetus-es. Earlier discordancy and monochorionicity pose increased mortality risks for the smaller twin. Antenatal size discordancy between twins can be best determined so-nographically. One common method uses sonographic fetal biometry to compute an esti-mated weight for each twin.

→What this article adds:
To check weight and weight discordance in twin fetuses, AC method has appropriate accuracy and compatibility. Although there is no significant statistical difference between the AC meth-od and EFW method, so a great research in this field is suggested in the future.

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is positively influenced by infertility treatment and by maternal age, race, heredity, and size. By contrast, the frequency of monozygotic twin births is relatively constant worldwide, approximately one set per 250 births. This incidence is generally independent of most demographic factors, except ART (1-3).

Multifetal gestations remain problematic for both the mother and her fetus.Specifically, the infant mortality rate for twins was more than four times the rate for singletons, and for triplets, it was 12-fold higher .Multifetal gestations are more likely to be low birthweight than singleton pregnancies due to restricted fetal growth and preterm delivery (4-6).

The mother may also experience higher morbidity and mortality rates, and these rise with the number of fetuses (7).

In multifetal pregnancies, the risks for preeclampsia, postpartum hemorrhage, and maternal death were twofold higher than these rates in singleton gestations (8). Rates of placenta previa and placenta accreta spectrum are increased (9).

Fetal size inequality develops in approximately 15 percent of twin gestations (10). Generally, as the weight difference within a twin pair grows, the perinatal mortality rate rises proportionately (11).

Earlier discordancy and monochorionicity pose increased mortality risks for the smaller twin. Specifically, with discordant growth identified at or before 20 weeks gestation in studies, 8 to 15 percent of the growth-restricted fetuses die (12-14).

The etiology of growth discordance in monochorionic twins likely differs from that in dichorionic twins.

In mono-chorionic twins, the single placenta is not always equally shared, and this leads to higher discordant growth rates than in dichorionic pairs (15).

In dichorionic twins, discordancy may result from various factors. Dizygotic fetuses may have different genetic growth potential, especially if they are of opposite genders. Second, because the placentas are separate and require more implantation space, one placenta might have a suboptimal implantation site. Additionally, umbilical cord abnormalities such as vela- mentous insertion, marginal insertion, or vasa previa may play a role (16).

The incidence of respiratory distress syndrome, intraventricular hemorrhage, seizures, periventricular leukomalacia, sepsis, and necrotizing enterocolitis rose directly with the percentage of weight discordancy (17, 18). Most discordancy surveillance begins after the first trimester (19).

Antenatal size discordancy between twins can be best determined sonographically.

One common method uses sonographic fetal biometry to compute an estimated weight for each twin (20) .Percent discordancy is then calculated as the weight of the larger twin minus the weight of the smaller twin, divided by the weight of the larger twin. Discordance is defined as an estimated fetal weight difference >20 percent (21).

Alternatively, given that abdominal circumference (AC) reflects fetal nutrition,some use the sonographic AC value of each twin.

With this method, some diagnose selective fetal growth restriction if the Ac measurements differ more than 20mm (22).

Nonstress testing and biophysical profile assessment have all been recommended in the management of twin growth discordancy (10).

So far, various research have been conducted all over the world in connection with this issue, each with different results (22-42).

According to what has been said, there is a possibility that the AC method along with EFW, will significantly improve the accuracy of birth incompatibility estimation weight. Considering that the current topic of research has not been looked at in a coherent way in the southwestern region of the country, this study aims to compare the weight of fetuses and the difference in the girth of the fetuses in twin pregnancies as a reliable method to predict weight. It was performed at birth in Imam Khomeini Hospital in Ahvaz in 2017-2019. It is hoped that the results of this study will have a positive effect on the quality of pregnancy of twin mothers and the resulting complications.

Methods

This was a descriptive, analytic, and retrospective study. The statistical population was all twin pregnant mothers referred to Imam Khomeini Hospital in Ahvaz from 2017 to 2019. The initial data set consisted of examination records of 1120 twin pregnancies.

Entering into the research includes all pregnant mothers with twins over 28 weeks of gestation of age ,with a successful termination of pregnancy and having a valid biometric ultrasound of both twins and having the results of Abdominal circumference (AC), head circumference (HC), femur length (FL) and the biparietal diameter (BPD).

Most of the exceptions were due to information from less than 28 weeks which included 298 cases, and another 180 cases were excluded for maternal or fetal reasons such as (one or both twins IUFD, cases of mono-chorion-mono-amnion twins ,smoking mothers). Also 102 cases were excluded for lack of an available sonographic data and essential informations in patient files.

The sample size was determined with a census (540 mothers).

EFW was based on FL, HC, AC, and BPD and used the Hadlock formula (43) during this research. Then, the difference in the weight of the fetuses (EFW Discordance) and the difference in the abdominal circumference of the fetuses (AC Discordance) were calculated as follows:

(AC/EFW) discordance =(larger twin (AC/EFW) −smaller twin (AC/EFW) / larger twin (AC/EFW)×100

The above values were compared with the birth weight discordance:

Birth weight discordance =(larger twin weight−smaller twin weight) / larger twin weight×100.

Information was collected through a checklist that included age, history of previous pregnancy, underlying diseases of the mother, body mass index, ultrasound in-

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formation, complications of the mother and the baby, birth weight, HC, FL, AC,BPD, and EFW which were collected and recorded through reviewing the clinical records of the patients, that have done at late second and third trimester and performed in Imam Khomeini Ahvaz Hospital.

All data were analyzed using SPSS version 18 statistical software. In order to evaluate the normal distribution of quantitative data (such as frequency), the Kolmogrov-Smirnov test was used. two-sided and unpaired t-test and Pearson correlation test were used to compare these two methods(AC and EFW). This research with the Ethical code of IR.AJUMS.HGOLESTAN.REC.1399.083 was approved by the research council of the Ahvaz university.

Results

The average age of the studied subjects was 29.39 ± 6.27, the average BMI was 24.4 ± 2.88, the average gestational age of the studied subjects was 31.71 ± 3.65 weeks, 18.3% of them were mono chorion-di-amnion and 81.7% were di-chorion-di-amnion. The average weight difference percentage in the EFW method was 9.25%, in the AC method, it was 9.89% and finally, at the time of birth, it was 10.72%.

Average education, abortion, infertility, background disease and chronicity are given in Table 1.

The correlation of the weight discordance in two fetuses in the AC method with the birth weight (r = 0.922 and $P < 0.001$) was higher than the EFW method with the birth weight (r = 0.69 and $P < 0.001$) (Table 2 and Charts 1 and 2).

In detecting a weight discordance of more than 20%, all sub-groups of diagnostic accuracy, including sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy in the AC method were significantly better than the EFW method and finally, the agreement rate-based on kappa In the EFW method, it was moderate (kappa = 0.584) and in the AC method it was excellent (kappa = 0.819). In detecting a weight discordance of more than 25%, sensitivity, negative predictive value and overall accuracy in the AC method were significantly better than the EFW method, and finally, the matching rate based on kappa in the EFW method was average (kappa = 0.457) and in the AC method was good (kappa = 0.68) (Table 3).

Table 1. Demographic characteristics of the research participants

	Frequency	Percentage
Level of education		
Unlettered	47	8.7
Elementary	102	18.9
Middle and high school	148	27.4
Diploma	168	31.1
University	75	13.9
Abortion hx		
No	460	85.2
Yes	80	14.8
Infertility hx		
No	439	81.3
Yes	101	18.7
Underlying dx		
NO	405	75
Yes	135	25
Chorionicity		
Mono chorion-Di amnion	99	18.3
Di chorion-Di amnion	441	81.7

Discussion

In summary, the results showed that the discordance in the weight of the fetuses in twin pregnancies in the EFW method is equal to 9.25%. In the AC method, it was 9.89% and finally, at the time of birth, it was 10.72%. The correlation of weight discordance in two fetuses in the AC method with birth time was higher than the EFW method with birth time. Also, in detecting the amount of difference greater than 20% and 25%, the power of AC detection and matching was excellent and good, but EFW was average. As far as the researchers of this study are concerned, this study was the first study in the southwestern region of the country, which evaluated the relationship between AC and EFW with birth weight in twin pregnancies.

Khalil et al.,in their study, investigated the difference in abdominal circumference and weight related to gestational age among 9866 sonographic evaluations, and the results showed that 1802 twins had di-chorion di-amnion and 323 mono-chorion di-amnion. The weight difference in 95% of the twins at 20 weeks of pregnancy increased from 18.3% to 21.9% at the 30th week of dichorion and diamnion twin pregnancies. And the abdominal difference was stable in this period and was 10-11%. The difference in weight and abdominal circumference in mono-chorion of di-amnions was slightly higher than in di-chorion of di-amnion, and in this study, it was found that abdominal circumference is a more accurate estimate of weight dif-

Table 3. Sensitivity and specificity, positive and negative predictive value of EFW and AC in detecting weight discordance greater than 20% and 25%

Weight discordance	Mgethod	True positive	False positive	True negative	False negative	Sensitivity	Property	Positive predictive value	Negative predictive value	Positive probability	Negative probability
More than 20%	EFW	41	7	451	41	50	98.5	85.4	91.7	33.3	0.507
	AC	62	3	455	20	75.6	99.3	95.4	95.8	108	0.245
More than 25%	EFW	18	2	484	36	33.3	99.6	90	93.1	83.25	0.669
	AC	34	8	478	20	63	98.4	81	96	39.37	0.376

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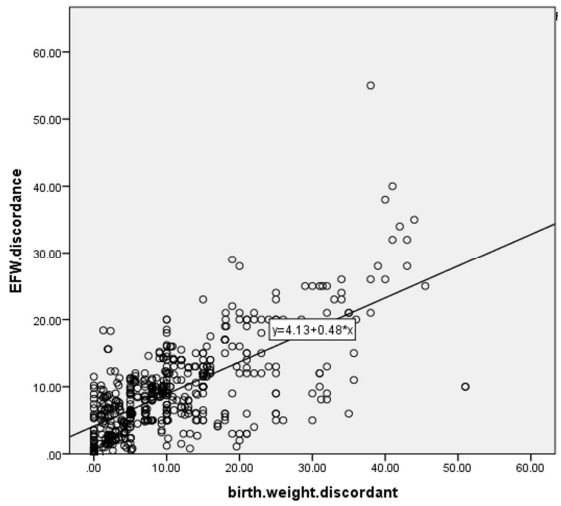

Chart 1. Correlation between the weight discordance in two fetuses based on the EFW method and the birth weight
R^2 Linear = 0.476

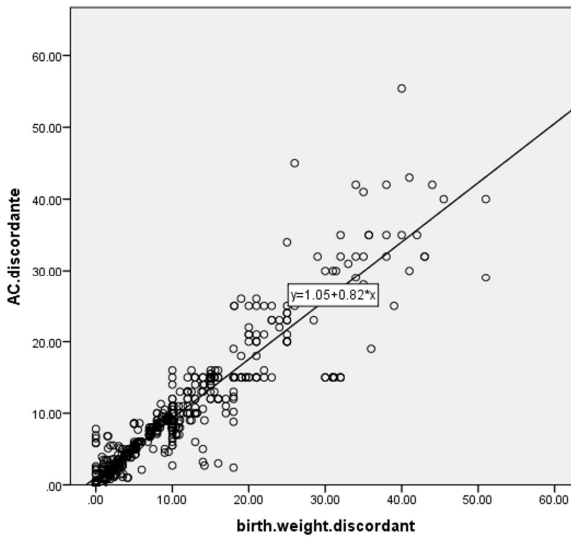

Chart 2. Correlation between the weight discordance in two fetuses based on the AC method and the birth weight
R^2 Linear = 0.850

ference (23). The findings of the mentioned study regarding the prevalence of di-chorion di-amnion and monochorion di-amnion twins are similar to the findings of our study and similar to the study. We found that the abdominal circumference is more accurate in estimating the weight difference.

Leombroni et al. showed in their research that a weight discordance of more than 20% had a sensitivity of 65.4% and a specificity of 90.8% in predicting a weight discordance of more than 20%. This prediction was made by ultrasound at intervals of 1 month, 2 weeks and 3 days before birth, and 61.4%, 72.3% and 78.9% predictions were correct, respectively. A weight discordance of more than 25% has a sensitivity of 57.7% and a specificity of 2.95% in predicting a weight difference of more than 25% at birth. The sensitivity of a weight difference of more than 25% identified in sonography 1 month, 2 weeks and 3 days before birth is The order was 60%, 75% and 60.3% and the specificity was 97.7%, 96.2% and 87.3%, respectively. Among the studies, a significant relationship was not possible for the changes in the abdominal circumference. The best diagnosis of abdominal circumference difference for predicting birth weight discordance was above 25% with 70.8% sensitivity and 86.4% specificity. In general, it was concluded that ultrasound has average accuracy in predicting weight differences in twins (30).

The sensitivity and sensitivity obtained in the mentioned study regarding AC are similar to our study, but in our study, it was found that AC has a good and excellent agreement in detecting the weight discordance of twin fetuses, but in the said study, a moderate agreement was shown that this Minor difference may be in the sample size of the study.

The results of nine studies (22-25 , 31-36) examined the diagnostic accuracy of AC incompatibility in predicting BW incompatibility. By systematic review of all nine studies, it was determined that AC incompatibility has a sensitivity of 57.9% and a specificity of 86.7 in predicting any degree of BW discrepancy. Optimal diagnostic performance for predicting BW ≥ 25% discordance was determined with a sensitivity of 70.8% and specificity of 86.4%. In our study, it was also found that the sensitivity and specificity of AC in detecting a difference of more than 25% between two embryos was equal to 63% and 98.4%, respectively. The sensitivity in this study is lower than the mentioned study, but higher specificity was reported in our study.

Also, seven studies (24 , 26-28, 31, 37, 38) examined the diagnostic performance of EFW ≥ 20% discordance in predicting the same degree of BW discordance. The diagnostic accuracy of ≥20% EFW discordance in predicting weight discordance ≥20% at birth was moderate, with a sensitivity of 65.4% , and specificity of 90.8%. All the weighting formulas used in the studies were effective in predicting such discrepancies. In the mentioned studies, the sensitivity of EFW ≥ 20%, which was diagnosed within 1 month, 2 weeks and 3 days before birth, in predicting discordance was 61.4%, 72.3 % and 78.9%. Two studies (28 , 37) examined the diagnostic performance of EFW ≥ 20% discordance in predicting BW ≥ 25% discordance, reported sensitivity of 77.5% and specificity of 90.7%.

Fourteen studies (22 , 27-29, 31-33, 35-37, 39-42) examined the diagnostic performance of ≥25% EFW discordance in predicting the same degree of BW discordance. When considering all studies, EFW ≥ 25% discordance had a sensitivity of 57.7% and a specificity of 95.2% for predicting discordance. BW was ≥ 25%. Sensitivity of EFW discrepancy ≥ 25% detected during 1 month, 2 weeks and 3 days before birth 60.0% (95% confidence interval (CI), 72.4-46.5%), 75.0% (95% CI, 83.6-64.4%) and 60.3% (95% CI, 68.6-51.6%) for predicting BW ≥ 25% discrepancy. The characteristic values are respectively 97.7%, 96.2% and 87.3%. Therefore, the findings of the mentioned studies regarding the overall diagnostic accuracy of EFW ≥ 25% are similar to our findings and they show the average diagnostic accuracy of EFW for both 20% and 25%. On the other hand, the present study

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has limitations such as being retrospective, small sample size, and being limited to one center.

Conclusion

The results of the present study showed that the average weight discordance of the fetuses in twin pregnancy was 9.25% in the EFW method, 9.89% in the AC method and finally 10.72% at birth. The correlation of weight discordance in two fetuses in the AC method with birth time was higher than the EFW method with birth time.

The difference is more than 20% and 25%; the diagnostic power and matching of AC was excellent and good, but EFW was average. Therefore, to check weight and weight discordance in twin fetuses, the AC method has appropriate accuracy and compatibility. Other large prospective studies to evaluate the diagnostic performance of AC and EFW discordance based on gestational age at scan, presented cut-off point, maternal and placental characteristics to determine the true diagnostic accuracy of ultrasound in predicting growth discordance in twin pregnancy and the optimal management option after this case are needed. It is suggested that future research should be conducted in a larger sample size in a multi-centered manner. It is also recommended that meta-analysis research is needed To examine the different dimensions of this issue.

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Authors Contribution

M.Barati had the original idea for this work. M.Motefares ,N.Saadati and M.Najafian designed the study. Data collection was done by M.Motefares . M.Barati and M.Motefares performed data analysis. The manuscript was written by M.Motefares. All authors reviewed and rewrote the paper and critically revised the draft of the manuscript and approved its final version.

Conflict of Interests

The authors declare that they have no competing interests.

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