The Role of Ultrasound in Early Pregnancy in Prediction of Miscarriages

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Abstract

Objective: Abortion is a multifactorial situation which is difficult to prevent. This study aimed to identify patients with a greater risk for pregnancy loss, depending on transvaginal ultrasound findings in early pregnancy weeks.

Methods: Patients presenting with the suspicion of pregnancy were taken into the study. Exclusion criteria were the presence of a known medical disorder and recurrent abortions. Depending on the time of referral, women were evaluated with transvaginal ultrasonography either during the 5-6th weeks or 7-8th weeks. Gestational sac dimensions, yolk sac diameter and morphology, crown-rump length and fetal heart rate were recorded. Patients were followed-up and these findings were compared with those of miscarriages.

Results: Eighty seven patients were included in the study. 19 of these (21%) were miscarriages. Mean gastational sac diameter did not demonstrate any differences between groups both in early pregnancy weeks or in the 7-8th weeks. Mean yolk sac diameter was high in the abortion group at early weeks (4.1 mm ± 0.9 vs 3.1 mm±1.0 mm, p=0.003). Yolk sac calcification was more frequent in abortus patients (3 vs1, p=0.001). Fetal heart rate was low in the abortus group in the second time-period (95.2±19 beat/min vs 110.9±22 beat/min, p=0.03). The difference between geastational sac diameter and CRL was >5 mm in all live births as compared to two pregnancies >5 in the abortus group.

Conclusion: Using ultrasonography in early pregnancy for determining the difference between gestational sac diameter and CRL, evaluating the diameter and morphology.

Keywords: Ultrasonography, gestational sac, yolk sac, abortion.

Erken gebelikte ultrasonografi bulgularının gebelik kayıplarını öngörmedeki yeri

Amaç: Abortus çeşitli faktörlere bağlı olarak gelişen, önlenmesi sorun olan durumlardandır. Bu çalışma erken gebelikte transvaginal ultrasonografi ile yapılacak bir değerlendirme ile abortus riski yüksek olabilecek olguları saptamak amacıyla planlandı.

Yöntem: Adet gecikmesi ve gebelik şüphesi ile başvuran hastalar değerlendirildi. Medikal hastalığı, tekrarlayan abortus hikayesi olanlar çalışmaya alınmadı. İlk başvuru zamanına göre 5-6. ve 7-8. gebelik haftalarındaki gebeler transvaginal ultrasonografi ile incelendi. Gebelik kesesi çapları, yolk kesesi çapı ve morfolojisi, baş-popo mesafesi, embriyo kalp atım sayısı kaydedildi. Bulgular ile ileride abortus yapan olguların bulguları karşılaştırıldı.

Bulgular: Çalışmaya kriterleri karşılayan 87 olgu dahil edildi. Bu olguların 19'u (%21) abortus ile sonuçlandı. Ortalama gebelik kesesi çapları gruplar arasında hem erken hem de 7-8. haftalarda anlamlı farklılık göstermemekteydi. Ortalama yolk kesesi çapı abortus grubunda erken dönemde yüksek iken (3.1 mm ± 0.9'a karşılık 4.1 mm±1.0 mm, p=0.003) , ikinci dönemde fark anlamlı değildi. Yolk kesesi kalsifikasyonu abortus olanlarda daha sık idi (1'e karşılık 3 olgu, p=0.001). İkinci dönemde abortus grubunda ortalama embriyo kalp atım hızı düşük bulundu (110.9±22 atım/dk'ya karşılık 95.2±19 atım/dk, p=0.03). Gebelik kesesi çapından CRL değeri çıkarıldığında elde edilen sonuç yaşayan olguların hepsinde >5 mm iken, abortus grubunda iki olguda bu değer > 5 mm'idi.

Sonuç: Erken gebelikte ultrasonografi ile; 'Gebelik Kesesi - baş-popo mesafesi' değerinin hesaplanması, yolk kesesi çapı ve morfolojisinin değerlendirilmesi, embriyo kalp atım sayının belirlenmesi gebelik prognozunun öngörülmesinde fayda sağlayabilecektir.

Anahtar Sözcükler: Ultrasonografi, gebelik kesesi, yolk kesesi, abortus.

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Introduction

In the early stage of pregnancy, the evaluation of the embryo and gestational sac during the diagnostic ultrasonography is important. For example, gestational age can be determined by the measurement of gestational sac and crown rump length and the examination of yolk sac, heart activity and corionic villus can show the existing problems in early period. In the studies for determining the risk factors in symptomatic patients, maternal age and the presence of severe bleeding show the likelihood of abortus.[1,2] In early period (Week 6-10), it was found that the 7.5% of the surviving fetus can experience abortus and the presence of fetal bradychardia and a gestational sac smaller than CRL are considered as the most important ultrasonographic markers of the loss of fetus.[2] In the results of another study, after the week 6-14 during which living fetus is determined, the rate of fetal loss decreased to 3.4%, whereas it was concluded that the count of heart beat cannot be beneficial in predicting the fetal loss.[3]

The aim of this study was to identify the cases with high abortus risk in early pregnancy by evaluating the gestational sac (GS), the diameter and morphology of yolk sac, the heart rate of embryo and CRL with transvaginal ultrasonography during the week 5-6 and 7-8 of the pregnancy.

Method

We evaluated the cases which admitted to our clinic with delayed menstruation and suspected pregnancy in May 2004-July 2005, did not want to terminate the pregnancy and has not previous recurrent abortus. The cases with diabetes mellitus, hypotiroidism, hypertension, autoimmune diseases and multiparities were excluded from the study. The cases with vaginal bleeding, subcoryonic hematoma, irregular gestational sac were not considered eligible for the study. The age, last date of menstruation, gravida and parity were recorded. Last date of menstruation was calculated with gestational week and, for the cases who don't know their last ate of menstruation, gestational week was determined with CRL measurement.

The study was planned to prospectively examine the two periods between week 5-6 and week 7-8 of the pregnancy according to the last date of menstruation or CRL. The evaluation, examination and follow-up were performed transvaginally by the same doctor using GE Logic 400 ultrasonography device. During the first period, it was evaluated whether the pregnancy is intrauterine, the gestational sac is regular and normal and the pregnancy is consistent with the last date of menstruation. Adnexial areas were investigated for ectopic pregnancy. With ultrasonography, the yolk sac was determined in week 5-6 and the CRL and fetal heart beat (FHB) were determined in week 7-8. To determine the dimension of gestational sac, antero-posterior and longitudinal diameters in sagital plan were measured. In addition, the transverse diameter of gestational sac in coronal plan was measured. These three values were averaged and recorded. The ultrasonographic age was recorded according to mean gestational sac diameter. In both period, where available, the morphology of yolk sac was examined; its regularity and the presence of ecogenicity were determined; in the plan where the best image was taken, the transverse diameter was measured from the outer edge to the other outer edge and the dimension was recorded in millimeter (Figure 1, 2). In the cases where the embryo was formed, CRL was measured in the best visible plan and in the longest axis and, in each case, the age of pregnancy was calculated by ultrasonography. Heart activity was examined and heart beat per minute was recorded.

The results of pregnancy were communicated by the hospital registries and by the tele-

Figure 1. A large yolk sac at 6th weeks.

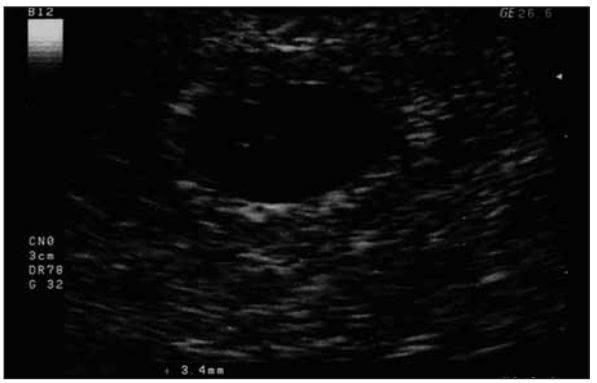

Figure 2. Yolk sac calcification.

phone from the patients. The data obtained from the study were combined in Excel 2000 software (Microsoft Corp, Redmond, IL, USA) and, thereby, the statistical analyze of the data designed in this manner was performed using SPSS (SPSS Inc., Chicago, IL, USA) program, Mann-Whitney U, Student t and chi-square test. P<0.05 was considered as statistical significance value.

Results

Ninety cases admitted to our clinic, which conforms to study criteria and are in early pregnancy, fulfilled the study criteria. Three of these cases were excluded because they terminated their pregnancy voluntarily. Some of the cases were only evaluated during week 7-8 because they presented in the second period. 57 cases presented in the first period, 30 cases presented in the second period and a total of 19 cases (21%) were aborted.

When the mean gestational sac diameter was evaluated, the mean gestational sac diameter of 39 cases whose pregnancy was continuing among the measures of 57 cases presented in early period (week 5-6) was calculated as 12.2±4.0 mm. In 18 cases which experience abortus, mean gestational sac diameter was found to be 14.0±5.0 mm (P=0.827) (Table 1).

During late period, in gestational sac comparisons performed in week 7-8, mean gestational sac diameter of 68 cases whose pregnancy was continuing was calculated as 17.8±5.8 mm. In 19 cases which experience abortus, mean gestational sac diameter was found to be 18.0±5.31 mm; this was not found to be statistically different (p=0.827). In four of 82 cases whose morphology can be clearly evaluated (4%), yolk sac was found to be ecogenic. In one of 66 cases (1.5%) with continuing pregnancy an increase of ecogenicity was present, whereas in 3 of 16 cases (18%) which experience abortus, yolk sac was found to be ecogenic. Mean yolk sac diameter measured during the first period was 3.1±0.9 mm in the surviving

Table 1. Early period and findings.

Findings at 5.-6. weeks	Alive (Mean+SD) (n=39)	Abortion (Mean+SD) (n=18)	P
Gestational age (mm)	12.22 ± 4.18	14.0 ± 5.85	0.827
Yolk sac (mm)	3.14 ± 0.94	4.17 ± 1.03	0.003

Table 2. Second period and findings.

Findings at 7.-8. weeks	Alive (Mean+SD)	Abortion (Mean+ SD)	P
Gestational sac (mm) (n=87)	17.81 ± 5.47 (n=68)	18 ± 5.31 (n=19)	0.827
Yolk sac (mm) (n=87)	4.64 ± 1.04 (n=68)	4.64 ± 1.36 (n=19)	0.763
Heart beat (beat/min) (n=49)	110 ± 22 (n=35)	95.2 ± 19 (n=14)	0.03
CRL (mm) (n=48)	4.64 ± 2.45 (n=48)	5.78 ± 2.77 (n=14)	0.178

embryos (n=18) and 4.1±1.0 mm in the cases which experience abortus (p=0,003) (Table 1). In the measurement of yolk sac performed in the second period (week 7-8), mean yolk sac diameter was found to be 4.6±1.0 mm in the cases which does not experience abortus. Mean yolk sac diameter was found to be 4.6±1.3 mm in the cases which experience abortus (P=0.763) (Table 2). Heart rate was evaluated in 49 cases during the second period. During the second period, mean heart rate was found to be 110.9±22 beats/min in 35 cases with continuing pregnancy and 95.2±19 beats/min in 14 cases which experience abortus (P=0.03). (Table 2). CRL was measured in the longest axis. Therefore, among 62 cases evaluated during the second trimester, 48 survived and 14 experienced abortus. Mean CRL value was found to be 4.6±2.4 mm in the cases with continuing pregnancy. Mean CRL value of the cases which experienced abortus was found to be 5.7±2.7 mm; no statistically significant difference was found (p=0.187) (Table 2). Mean gestational sac diameter minus CRL was always found to be >5 mm in the cases which did not experience abortus and <5 mm in two cases which experienced abortus. During the follow-up, Down syndrome was detected in one case. In this case, gestational sac diameter in first trimester was 11,8 mm, gestational sac diameter in the second trimester was 16.1 mm and yolk sac was observed to be round and normal. Yolk sac was 3.5 mm in the first period and 4.2 mm in the second period, whereas heart rate was found to be 90 beats/min.

Discussion

With the examinations performed during the early pregnancy using the ultrasonography, gestational sac and yolk sac diameters and CRL of the embryo is measured and heart rate of the embryo can be calculated. The predicting sensitivity of these data for pregnancy course and prognosis was investigated in several studies in the literature.

In the study performed by Oh and colleagues,[4] a difference between the sac diameters of the cases which experienced abortus and the cases with continuing pregnancy was not found between Days 28-35 but was found between Days 36-42. Gestational sac diameters of the cases which experienced abortus were found to be less than those of the cases which did not experience abortus.

In the study performed by Cunningham and colleagues,[5] 40 pregnant women was examined with transvaginal ultrasonography between week 5-12 and it was observed that gestational sac of the cases which experienced abortus was smaller than normal, starting from week 5.

In a study performed by Acharya and colleagues,[6] 86 pregnant women were followed up and a three dimensional measurement was performed using a transvaginal ultrasonography in week 4; among these cases, 46 experienced abortus and no difference was found between the cases which experienced and did not experience abortus for gestational sac volume. In our study, no difference was found between the cases which experienced and did not expe-

rience abortus for the gestational sac dimension in the measurements done in both periods.

In the study performed by Lindsay and colleagues,[7] it was reported that the likelihood of abortus in the cases with a yolk sac diameter greater than normal (>5.6 mm before week 10) is high. In the results of a recent study, it was reported that a yolk sac with great diameter can be present during a normal pregnancy but the presence of a regular yolk sac with great diameter, in the cases where no embryo is seen, can be a sign of pregnancy loss.[8] In our study, mean yolk sac diameter of the cases which experienced abortus during the first period was found to be greater than the surviving cases; the difference was found to be statistically significant. During the second period (week 7-8), no difference was found between the yolk sac diameters. In our study, we found that the measurement of yolk sac during the week 5-6 of the pregnancy can be beneficial in foreseeing the abortus.

Harris and colleagues reported that two cases with yolk sac calcification and ecogenicity increase experienced abortus and suggested that the yolk sac calcification can be related to typical dysmorphic modifications or the presence of the calcium-binding proteins.[9] In our study, 4 cases showed increase of ecogenicity and a possible calcification in yolk sac and three of these cases experienced abortus. Therefore, we believe that it should be noted that the cases with yolk sac calcification during early pregnancy period can show poor prognosis of pregnancy. In a study performed by Bromley and colleagues,[10] the cases with a small (GS-CRL < 5mm) and normal gestational sac were separated in the examination performed in week 5.5-9 and the frequency of abortus was 94% in the cases with a small gestational sac and 8% in the normal cases. We evaluated the cases of our study by extracting CRL value from mean gestational sac diameter. Consequently, the value was found to be ≥5 mm in all cases with continuing pregnancy but <5 mm in two cases which experienced abortus. Because of this statistically significant difference, we believed that calculating the "mean gestational sac diameter-CRL" value during early pregnancy can be beneficial in foreseeing the prognosis of the pregnancy.

In the literature, mean heart beat reported during week 7-8 of the pregnancy was 140-160/min. In addition, in this study performed between weeks 6-12 of the pregnancy, the threshold for the risk of fetal loss was reported to be 120 beats/min. In our study, the reason for which mean heart rate in the cases with continuing pregnancy was lower (110 beats/min) can be the method of ultrasonography M mode that we did not used and the small number of cases.

In the results of another study, it was reported that the survival rate of the embryos who have a slow heart rate at week 7 and before (<100 beats/min, week 6.2; <120 beats/min, week 6.2-7) was only 61.6% and that the risk of anomaly was increased in survivors.[12] According to the heart beat count that we found in our study, mean value was found to be less in the cases which experienced abortus in the second period than the cases which did not experience abortus and it was found to be 95 beats/min (p=0.03).

In addition, the case for which Down syndrome was detected had a heart rate of 90 beats/min. In the light of this statistically significant finding, it can be recommended to count the heart beat during week 7-8.

In the literature, risk of abortus was 7-24% in the cases with a CRL <5mm (<6.GH) and 3.3% in the cases with a CRL 6-10mm (6-7GH). In our study, this ratio was 21% in the sum of the two period and 28% in the cases in which the heart beat was detected in the second period. It was thought that these high values can be related to the small number of cases.

Discussion

In conclusion; calculation of the value of 'Gestational sac-CRL', evaluation of the diameter and the morphology of the yolk sac, determination of the heart rate, by the rutine sonographic examination at first trimester might be helpful in the detection of the cases with increased risk of abortion.

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