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Umbilical Artery Doppler Ultrasound for the Determination of Chorionicity in Twin Pregnancies

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Abstract

Background: Maternal and perinatal complications are higher in twins than in singleton pregnancies. This complications rate is directly related to placental chorionicity in twin pregnancies. Early diagnosis of twins and their chorionicity is necessary to reduce the perinatal mortality. It can be determined by different methods in the first trimester. Ultrasonography is a valuable tool in management of twin pregnancy. Ultrasound in evaluation of the chorionicity decreases later in gestational weeks. The aim of this study is to determine the chorionicity by using Doppler ultrasonography in second and third trimesters.

Methods: Patients were divided into two groups according to their chorionicity. Pregnancies with dichorionic placentas were included into group 1, while with monochorionic placentas were included into group 2. In both groups, PI, RI and S/D indices of umbilical artery were measured in each fetus. Whether there is a significant difference between the groups in the Doppler parameters was evaluated.

Results: The PI, RI and S/D indices of umbilical artery doppler ultrasonography were different between the twins with dichorionic placentas ($p < 0.05$), but they were similar in twins with monochorionic placentas.

Conclusions: Based on our study results, we suggest that the Doppler ultrasonography can be useful method for chorionicity determination of twin pregnancies at second and third trimesters, if chorionicity has not determined until the end of second trimester.

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Introduction

Fueled largely by infertility therapy, over the past 25 years, both the rate and the number of twin and higher-order multifetal births have increased [1]. Between 1980 and 2005, the twin birth rate rose from 18.9 to 32.6 per 1000 live births [2]. Twin fetuses usually result from fertilization of two separate ova, dizygotic twins. Less often, twins arise from a single fertilized ovum that subsequently divides monozygotic twins. Incidence of dizygotic twin is 1:90 and monozygotic twin is 1:250 [3].

The identification of chorionicity can aid obstetrical risk assessment and guide management of multifetal gestation. The incidence of twin specific complications varies in relation to zygosity and chorionicity, the latter being the more important determinant. There are increased rates of perinatal mortality and neurological injury in monochorionic twins compared with dichorionic pairs [4, 5]. High fetal death rate in monochorionic twins may result from cord entanglement, congenital anomaly, preterm birth, or twin to twin transfusion syndrome (TTTS) [6]. Demise of one of the fetuses in monochorionic twins renders serious problems to the living fetus. Due to vascular anastomoses, factors which cause hypoxic damage to the neurologic system pass into the circulation of the living fetus. In addition, invasive procedures for prenatal diagnosis can be affected from chorionicity. In fetal reduction procedures involving one of the monochorionic twins, the other fetus may also be affected. Due to these facts, early diagnosis of twins and their chorionicity is necessary to reduce perinatal mortality. Chorionicity can be determined by ultrasonography in the first trimester. The presence of two separate placentas and a thick, generally 2 mm or greater dividing membrane supports a presumed diagnosis of dichorionicity. This image also is named the lambda sign. Fetuses of opposite gender are almost always dizygotic, so dichorionic [7]. In contrast, monochorionic pregnancies have a dividing thin membrane. This membrane is generally less than 2 mm,

Table 1. Demographical and clinical features of patients

	Dichorionic placental group (n:39)	Monochorionic placental group (n:11)	p
Maternal age (year)	27.1 ± 4.2	25.2 ± 6.0	> 0.05
Parity	1.3 ± 0.8	1.0 ± 0.5	> 0.05
*Gestational age	28.0 ± 3.2	27.3 ± 2.1	> 0.05
Delivery week	33.1 ± 2.2	30.1 ± 2.8	< 0.05
Cesarean (n, %)	27, 70%	8, 73%	> 0.05

*The gestational week during umbilical artery doppler measurement.

and magnification reveals only two layers. This image is also named the T sign [8]. But, the determination of chorionicity may be tough after 14th week of pregnancy, because of this signs cannot be seen after this week.

We planned our study hypothesis that umbilical artery Doppler indices in monochorionic twins which use the same placenta should be similar compared to dichorionic twins which have separate placentas. Our aim was to determine chorionicity in 2nd and 3rd trimesters by using Doppler ultrasonography.

Patients and Methods

Fifty healthy pregnant women who attended to Ataturk University Obstetrics and Gynecology polyclinic between 2004 and 2006 were included in this study. Diagnoses of all these twin pregnancies were made by first trimester ultrasonography. All women were informed about the study. Gestational age was determined by date of the last menstruation and/or first trimester ultrasonography.

Ultrasound examinations were undertaken between 24 - 34 weeks of pregnancy by using Shimadzu-2200 ultrasound device, 3.5MHz convex probe. Umbilical artery indices were measured from the free loop of umbilical arteries of each fetus. Umbilical artery systolic/diastolic ratio (S/D), pulsatility index (PI) and resistance index (RI) values were recorded. Placental structures of all women included to the study were examined following delivery. Patients were divided into 2 groups according to their chorionicity. Women with dichorionic placentas were included into group 1 while women with monochorionic plasentas were included into group 2. Twins with different sexes and twins with the same sex but separate placentas following delivery were included in group 1. Placentas of the twins of the same sex and were single in structure were examined morphologically. Evaluation of neighboring regions of two amniotic membranes which revealed two separate amniotic and chorionic membranes were included into group 1 while two amniotic membranes and one chorionic membrane were included into group 2.

PI, RI and S/D indices of first and second fetuses of women in both groups were compared to evaluate whether there was statistically significant difference between the two groups. Results belonging to the group 1 and group 2 were compared to reveal whether there was significant difference between the groups in terms of Doppler parameters.

For statistical evaluation of the result, SPSS 11 software was used. Paired sample t-test was used for the evaluation of data. P-values less than 0.05 were accepted as significant.

Results

Fifty twin pregnancies were included the study. In this twin pregnancies, 39 (78%) of them had dichorionic placenta, while 11 (22%) of them had monochorionic placenta. There were no statistically differences in maternal age and parity, and gestational week between groups. The gestational week during umbilical artery Doppler measurement was 28.0 ± 3.2 in twin pregnancies with dichorionic placenta, and it was 27.3 ± 2.1 with monochorionic placenta ($p > 0.05$) (Table 1).

Evaluation of umbilical artery doppler results of twins with dichorionic placenta revealed that PI, RI and S/D indices were different between each twin ($p < 0.05$). But, they were similar between the each twin in pregnancies with monochorionic placenta (Table 2).

Discussion

Twinning rate is 32.1 per 1000 live births [2]. There is now

Table 2. Umbilical artery doppler indices of dichorionic (Group 1) and monochorionic (Group 2) twins

	Fetus 1	Fetus 2	p
Group 1			
PI	1.09 ± 0.2	1.01 ± 0.1	< 0.05
RI	0.7 ± 0.1	0.7 ± 0.1	< 0.05
S/D	2.6 ± 0.6	2.4 ± 0.5	< 0.05
Group 2			
PI	1.12 ± 0.2	1.09 ± 0.2	> 0.05
RI	0.7 ± 0.8	0.7 ± 0.9	> 0.05
S/D	2.5 ± 0.6	2.4 ± 0.6	> 0.05

evidence that the incidence of zygotic splitting is also increased following ART [9]. Pregnant women with twin fetuses have more risks for themselves and their fetuses than pregnant women with singleton pregnancies. Perinatal mortality rate is 3 - 6 times higher in twin pregnancies than singleton pregnancies. This perinatal mortality rate is directly related to placental chorionicity in twin pregnancies. Also, perinatal death has been 3 - 5 times higher in pregnancies with monochorionic placenta than pregnancies with dichorionic placenta [10]. The outcome of the monozygotic twin process depends on when division occurs. If zygotes divide within the first 72 hours after fertilization, two embryos, two amniotic membranes, and two chorionic membranes develop, and a diamniotic, dichorionic twin pregnancy evolves. If division occurs between the fourth and eighth day, a diamniotic, monochorionic twin pregnancy results. By approximately 8 days after fertilization, the chorion and the amnion have already differentiated, and division results in two embryos within a common amniotic sac, that is, a monoamniotic monochorionic twin pregnancy [1].

Determination of chorionicity can aid obstetrical risk assessment and guide management of multifetal gestation. There are increased rates of perinatal mortality and neurological injury in monochorionic diamniotic twins compared with dichorionic pairs [4, 5]. Monochorionic twins have vascular anastomosis that is responsible for increased mortality and morbidity. TTTS is one of the most important consequences of this vascular anastomosis. TTTS is a specific syndrome for monochorionic twin. Death of one fetus at monochorionic pregnancy is a serious problem for the other one. Fetal loss before 24 weeks gestation generally results from early starting TTTS. Fetal growth retardation occurs in 34% of monochorionic placenta and in 23% of dichorionic [11]. In case of death of one of twin in monochorionic placenta is seen 25% of neurological damage and 25% of death for other twin. Because of thromboembolic factors arising from dead fetus, the living fetus can get severe brain damage or even he/she can die [11]. Premature birth and related complications are threats for all twins, especially twins with monochorionic placenta. The risk of preterm birth before 32 weeks is 5.5% in dichorionic twins and almost double (9%) in monochorionic twins [12]. Also, invasive procedure for prenatal diagnosis is affected by chorionicity. The other fetus in twin pregnancy with monochorionic placenta can be affected from fetocide procedure. Due to all these reasons, diagnosis of twins and their chorionicity is necessary to reduce perinatal mortality. In multifetal gestations, chorionicity of placentas can be determined with high accuracy specificity and sensitivity by ultrasound examination at the first and the early stage of the second trimester [10]. Different methods for ultrasonographic evaluations can be used for the detection of chorionicity. If genders of fetuses are different from each other in ultrasound, type of zygosity is always dizygotic. Rarely, monozygotic twins may be discordant for phenotypic sex. This occurs if one twin is phenotypic ally female due to Turner syndrome (45, X) and her sibling is 46, XY [1]. If two separate placentas are seen at the first 8 weeks of pregnancy, the type of placenta is dichorionic. In a study with 110 twin pregnancies, Scardo and colleagues found that a single placental mass has 50% positive predictive value for monochorionic placenta by first trimester ultrasound [8]. So, a single placental image in ultrasound is not useful for the determination of chorionicity after the first trimester. Chorionicity of placentas in twin pregnancies can be determined

by counting membrane between fetuses on high-resolution ultrasound. This method has predictive value for 100% of dichorionic placentas and 95% of monochorionic placentas [13]. But, this method is not appropriate after the first trimester of the pregnancy due to technical reasons.

In a retrospective study including 360 patients, the pregnancies have been categorized as monochorionic or dichorionic based on the existence of lambda occurrence after the 14th week of the pregnancy. After the deliveries, it was seen that all the chorionicity had been diagnosed correctly [14]. However, these findings are not available after 14 weeks of pregnancy. Another method for diagnosing chorionicity is, measuring the thickness of the membranes between the fetuses. Because of dichorionic placenta contains additional two chorionic membranes, it is thicker than monochorionic placentas. Membrane thickness of dichorionic placentas is 2.4 mm on average, while median membrane thickness of monochorionic placenta is 1.4 mm [15]. This method can't be used after second trimester for membrane thickness is reduced. Doppler ultrasonography is generally used for early detection and follow-up of fetal growth retardation and preeclampsia. In our study, we used Doppler ultrasonography to confirm chorionicity of placentas in twin pregnancies at second and third trimester. We measured Doppler indices of fetal umbilical arteries at monochorionic and dichorionic twin pregnancies. We found a statistical differences for PI, RI, and S / D values between fetuses in dichorionic twins. But, there was no difference between each fetus in monochorionic pregnancies.

It can be thought that if the detection of Doppler indices of umbilical arteries is different, chorionicity of placentas is monochorionic, but it is the same, if the chorionicity of placentas is dichorionic. There hasn't been any study on this topic in literature. A new study with proper patient size and utilizing the Doppler measurement for chorionicity diagnosis might yield to helpful clues for clinical practices. Based on our study results, we suggest that the Doppler ultrasonography can be useful method for determination of chorionicity in twin pregnancies at the second and third trimesters, if the chorionicity has not determined until the end of second trimester.

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