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Research Article

Second trimester uterine artery pulsatility index and chorionicity in twins

Rahime Nida Ergin[1]*, Murat Yayla[2]

[1]Department of Gynecology& Obstetrics, Bahcesehir University, Istanbul, Turkey
[2]Department of Gynecology& Obstetrics, International Hospital, Istanbul, Turkey

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***Correspondence:**
Dr. Rahime Nida Ergin,
E-mail: drnidaergin@gmail.com, drnidaergin@yahoo.com

ABSTRACT

Background: We aimed to compare the second trimester uterine artery Pulsatility Index (PI) measurement in twin pregnancies according to the chorionicity and determine its effect on twin pregnancy outcome in terms of fetal and birth weight.
Methods: All medical records of twin pregnancies, whose fetal screening was done between May 1999 and January 2012, were evaluated retrospectively. All twin pregnancies without detected/suspicious anatomical or genetic fetal anomalies, biochemical abnormalities, and familial genetic diseases were included in the data analyses. Ones with missing PI measurements and ones with undetermined chorion types were excluded from the data analyses.
Results: A total of 149 twin pregnancies were evaluated. The percentages of chorion types were diamniotic dichorionic in 89.9% (n=134) and diamniotic monochorionic 10.1% (n=15). Mean age of the mothers was 31.56 ± 4.9 years. Mean gestational week of PI measurement was 20.30 ± 2.23 weeks. Mean birth week was 35.5 ± 2.50 weeks. Mean birth weight was 2405 ± 437 grams. Correlation analyses related to PI values and second trimester weight and birth weight parameters didn't show any statistically significant correlation. Mean maternal age, mean gestational week of PI measurements, mean birth week, mean fetal weights and birth weights were indifferent between chorionicity groups. Comparisons of second trimester PI, second trimester weight and birth weight and related parameters showed no statistically significant between groups.
Conclusions: Second trimester uterine artery pulsatility index measurements do not differ between chorionicity types. It has no effect on twin pregnancy outcome in terms of fetal weight and birth weight.

Keywords: Fetus, Pregnancy, Twin, Ultrasonography, Doppler, Uterine artery, Pregnancy trimester, Second, Chorion

INTRODUCTION

In case of preeclampsia, failure trophoblastic invasion results in an altered Doppler ultrasound blood flow pattern and increase Resistance Index (RI) and uterine artery Pulsatility Index (PI) in the uterine arteries in the first and second trimester of pregnancy in singletons and twins.[1] Therefore, PI and RI measurements have taken a pivot role in predicting and follow of preeclampsia.[2-15]

In the literature, chorionicity has been shown to affect perinatal outcome related to intrinsic placental pathologies.[16,17] Other than these differing intrinsic placental pathologies, the uterine artery related parameters affecting placental blood flow might also differ due to chorionicity. Therefore, we aimed to compare the second trimester uterine artery PI measurements together with uterine artery RI measurements in twin pregnancies according to the chorionicity and determine its effect on twin pregnancy outcome in terms of fetal and birth weight.

METHODS

All medical records of twin pregnancies, whose fetal screening was done between May 1999 and January

2012, were evaluated retrospectively. All twin pregnancies without detected/suspicious anatomical or genetic fetal anomalies, biochemical abnormalities, and familial genetic diseases were included in the data analyses. Ones with missing PI measurements and ones with undetermined chorion types were excluded from the data analyses. Chorion types were determined before 14th gestational week according to either presence or absence of placenta tissue protruding thorough the base of inter-twin membrane. The presence, namely 'Lambda sign' denoted for dichorionic type and absence 'T sign' denoted for monochorionic type.

Sonographic examinations were performed transabdominally using one type of ultrasonography machine (Voluson 730 Expert TM; GE Healthcare, Milwaukee, WI, USA). As depicted previously in literature, bilateral uterine arteries crossing the external iliac arteries were identified by means of color Doppler sonography. Keeping the angle of insonation less than 30 degrees, pulsed wave Doppler was performed to obtain three similar consecutive waveforms and uterine artery PI and RI values were measured.[2,3]

The comparisons of maternal age, gestational week of PI measurements, birth week, fetal weights and birth weights for chorionicity groups were performed with ANOVA test. Correlation analyses of PI measurements with other parameters were performed with Pearson's correlation. Statistical analyses were performed using SPSS statistics software (SPSS Statistics for Windows, Version 17.0; SPSS Inc., Chicago, U.S.A). P value was set as <0.05 for significance.

RESULTS

A total of 149 twin pregnancies were evaluated in the analyses. The percentages of chorion types were diamniotic dichorionic in 89.9% (n=134) and diamniotic monochorionic 10.1% (n=15). The mean age of the mothers was 31.56 ± 4.89 years. Mean gestational week of PI measurement was 20.30 ± 2.23 weeks. Mean birth week was 35.5 ± 2.50 weeks. Mean birth weight was 2405 ± 437 grams.

Correlation analyses related to PI values and second trimester weight and birth weight parameters did not show any statistically significant correlation. Mean maternal age, mean gestational week of PI measurements, mean birth week, mean fetal weights and birth weights were indifferent between chorionicity groups.

Comparisons of second trimester PI, second trimester weight and birth weight according to chorionicity are shown in the Table 1. No statistically significant difference was found between groups related to all parameters. In Figure 1 and Figure 2 distribution of PI and RI measurements are shown in box-plot graph respectively. The percentiles of bilateral and mean PI and RI measurements are shown in the Table 2.

Table 1: Comparisons of second trimester uterine artery PI, second trimester weight and birth weight according to chorionicity.

Chorion type	Right UtA PI	Left UtA PI	Mean UtA PI	Mean fetal weight at 2nd trimester	Mean birth weight
Diamniotic dichorionic	0.897 ± 0.432	0.840 ± 0.271	0.881 ± 0.266	388.0 ± 151.6	2442.9 ± 404.5
Diamniotic monochorionic	0.895 ± 0.262	0.862 ± 0.148	0.890 ± 0.205	359.7 ± 137.1	2785.0 ± 363.95

UtA PI: Uterine artery pulsatility index

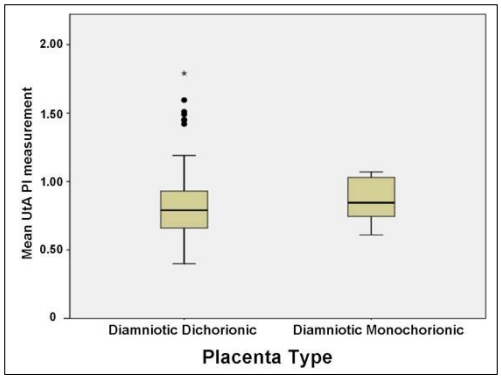

Figure 1: Mean uterine artery PI distribution according to chorionicity.

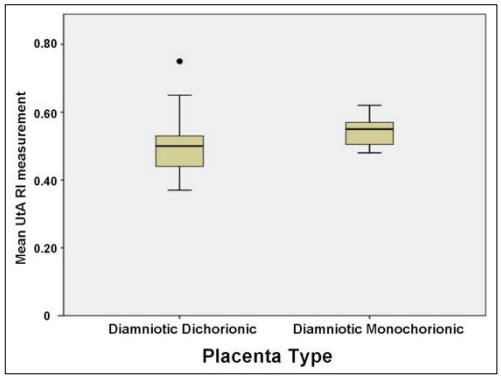

Figure 2: Mean uterine artery RI distribution according to chorionicity.

Table 2: The percentiles of uterine artery pulsatility index and uterine artery resistance index.

Percentiles	Right UtA PI	Left UtA PI	Mean UtA PI	Right UtA RI	Left UtA RI	Mean UtA RI
5	0.540	0.474	0.474	0.410	0.386	0.386
50	0.760	0.820	0.805	0.480	0.505	0.500
95	2.090	1.450	1.466	0.640	0.695	0.695

UtA PI: Uterine artery pulsatility index
UtA RI: Uterine artery resistance index

DISCUSSION

In the pathogenesis of pregnancy hypertensive disorders and especially preeclampsia, impaired trophoblastic invasion seems to be responsible.[1] In turn; it causes an altered Doppler ultrasound blood flow pattern and increase in Resistance Index (RI) and uterine artery Pulsatility Index (PI) in the uterine arteries in the first and second trimester of pregnancy in singletons[2-11] and twins.[12-15] Therefore, PI and RI measurements have taken a pivot role in predicting and follow of preeclampsia.[2-14]

Chorionicity has been shown to affect perinatal outcome related to intrinsic placental pathologies.[16,17] Although similar intrauterine growth retardation ratios have been found in both monochorionic and dichorionic twins, poor perinatal outcome was more common in monochorionic twins.[16,17] Especially, in case of discordant twins lesser placental weight and umbilical cord abnormalities were common in monochorionic twins.[17] The rationale for this early-onset discordant growth in monochorionic twins has been attributed to unequal placental sharing whereas transfusion imbalance has been attributed to the late-onset discordant growth.[18] Likewise to these differing intrinsic placental pathologies, that the uterine artery related parameters may differ due to chorionicity has been studied in this study.

Uterine artery PI measurements performed with either transvaginal or transabdominal Doppler USG has proved mean PI measurements meaningful in predicting PI.[5,6] In this study we performed uterine artery Doppler studies with transabdominal Doppler USG, accordingly to the methodological criteria previously described.[2,3] Besides elevated cross-sectional mean uterine artery PI measurements, sequential changes in uterine artery PI measurements in first and second trimesters have been shown to predict adverse prenatal outcome, especially persistence of an abnormal mean PI from the first to the second trimester had the greatest risk (OR, 10.7; 95% CI, 3.7–30.9).[7] Again, percentiles of the ranked PI measurements in the second trimester have been associated with adverse pregnancy outcome in twins.[14] However, this has not been confirmed in singletons,[11] though one study discussed lowest PI to be more sensitive for preeclampsia in singletons.[10] As well as, mean RI values[8] combination of Resistance Index (RI) measurements and the assessment of diastolic notches have been shown to predict pregnancy-induced hypertension and fetal growth restriction better when performed at 20 weeks.[4]

Up to date 3 studies have performed analyses of PI measurements according to the chorionicity from different countries namely, England, Austria and Germany.[13-15] This study shows the results from Turkey. Two of these studies included both monochorionic and dichorionic twins but they have included all cases including ones with pregnancy adverse outcomes to provide a cut off value/percentage for predicting pregnancy adverse outcome.[13,14] One study included dichorionic twins only, but they provided nomograms of mean uterine artery PI and mean uterine artery RI values related to 17^{th}-38^{th} gestational weeks.[15] Our study included 20^{th} week uterine artery PI and RI measurements in both monochorionic and dichorionic twins and their comparisons.

In the study of Klein K et al. which studied uterine artery PI in all cases including ones with pregnancy adverse outcomes at 20-22 gestational weeks, the median of the lowest, mean, highest PI of uterine arteries was found as 0.69, 0.79 and 0.87 in twins and no statistical significant difference was found between uterine artery PI measurements of monochorionic and dichorionic twins.[14] In that study mean, lowest, and highest PI above the 95th percentile were described as significant risk factors for preeclampsia and adverse pregnancy outcome. In the study of Yu CHK et al. which also studied uterine artery PI in all cases including ones with pregnancy adverse outcomes at 22-24 gestational weeks, median of mean uterine artery PI was 0.90 in dichorionic twins and 0.95 in monochorionic twins and there was no statistical difference between chorionicity groups.[13]

In the study of Geipel et al., any twin pregnancy with maternal complications (diabetes, hypertension, preeclampsia) and fetal complications (major abnormalities, growth restriction) was excluded to provide normative distribution of uterine artery PI and uterine artery RI measurements from 17^{th} to 38^{th} gestational weeks, but included dichorionic twins only.[15] This study included monochorionic and dichorionic twins, studied uterine artery dynamics in a cross sectional manner at 20th gestational week and compared according to chorionicity. In the study of Geipel et al.,

corresponding to our timing, 5th, median and 95th percentiles of uterine artery PI and uterine artery RI at 20th gestational week were 0.531; 0.817; 1.259 and 0.388; 0.528; 0.669 respectively.[15] Our results were similar to this study, and we confirmed that these measurements do not differ between chorionicity groups. In addition, we showed that second trimester uterine artery pulsatility index measurements have no effect on twin pregnancy outcome in terms of fetal weight and birth weight.

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Ethical approval: Not required

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