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Comparing Perinatal Outcome in Twin and Singleton Pregnancies Regarding Doppler Evaluation of Uterine Artery Indices in the Second Trimester

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Abstract

Background: Prediction of adverse perinatal and postnatal outcomes could be possible by using ultrasound Doppler evaluation, however there are some controversies regarding this issue in the literature. The goal of present study was to evaluate predictive value of Doppler indices in single and twin pregnancies during second trimester.

Materials and Methods: This prospective study was conducted in Yas Hospital, Tehran, between February 2015 and January 2016. The number of 71 singleton pregnancies and 59 twin pregnancies enrolled in this study. A single expert perinatalogist / sonographer did all Doppler ultrasound exams and followed up cases until the end of pregnancy. To compare Doppler indices and pre-postnatal outcomes between singleton and twin groups, the Student's t-test, Pearson $\chi 2$ test and Fisher's exact test were used for continue and categorical variables, respectively.

Results: Rates of preterm delivery and SGA were significantly higher in twin pregnancies compared with singletons ($P<0.001$). Mean PI in singleton pregnancies was significantly higher than in twin pregnancies (1.4±0.8 vs. 0.6±0.2; $P<0.001$). On the other hand mean RI in twin pregnancies was significantly higher than the counterpart group (0.8±0.4, 0.6±0.2; $p=0.002$). Doppler ultrasound indices were not significantly different in singleton and twin pregnancies with and without complications ($P>0.05$).

Conclusion

According the results, the mean PI of uterine arteries in twin pregnancies in the second trimester was significantly lower than singleton pregnancies. On the other hand this value did not differ between perinatal complicated and uncomplicated pregnancies.

Key Words: Pregnancy Outcome, Twin pregnancy, Ultrasonography Doppler, Women.

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1- INTRODUCTION

Doppler evaluation of uterine arteries could be applied during pregnancy to predict adverse perinatal and postnatal complications (1). Impaired placentation will lead to high impedance to flow in the uteroplacental circulation along with preeclampsia, Intrauterine Growth Restriction (IUGR), placenta abruption, and stillbirth (2). Uterine artery Doppler evaluation as a non-invasive, fast and cost-effective technique is used for appropriate screening test during pregnancy. Decline of uterine artery flow happens by increasing gestational age (3). Uterine artery Doppler measurements could be done by assessment of pulsatility index (PI) or resistive index (RI) (4). Abnormal uterine artery findings have been considered as the best predictive factors for adverse pregnancy outcomes (5-7).

The most Doppler evaluations of uterine arteries are conducted in the second trimester (20 to 26 weeks' gestation) (8-10). Sensitivity and specificity of Doppler indices were reported extensively different in former studies (2, 11, 12). Prediction of adverse perinatal and postnatal complications may possible by using ultrasound Doppler evaluation, however there are some controversies regarding this issue in the literature. Moreover literature review showed that few studies have been conducted to examine ultrasound Doppler indices in twin pregnancies. Therefore this study was conducted to compare the predictive value of Doppler indices in single and twin pregnancies during second trimester.

2- MATERIALS AND METHODS

2-1. Study setting and subjects

This prospective study was conducted in Yas Hospital affiliated to Tehran University of Medical Sciences (Tehran, Iran) between February 2015 and January 2016. Singleton or twin pregnant women with gestational age 16 to 24 weeks were selected for this study and finally 71 singleton pregnancies and 59 twin pregnancies enrolled in this study by considering $\alpha = 0.05, \beta = 0.2$, doppler sensitivity of the uterine artery in predicting complications during pregnancy in singleton and twin pregnancies equal to 10% and 26%, respectively (13).

2-2. Eligibility criteria

Exclusion criteria were previous cesarean section, any history of diabetes, hypertension, cardiac or renal disease, preeclampsia, Intrauterine Growth Restriction (IUGR), and abnormal screening tests.

2-3. Measurement tool

All participants were followed up until time of delivery and during parturition. We used a researcher made checklist including: Demographic data related maternal age, level of education; numbers of gravida and para, gestational age (based on last menstrual period and ultrasound examination), number of gestations, perinatal complications like diabetes, gestational diabetes, Hypertension (HTN), preeclampsia and placental abruption.

2-4. Technique

A trained Primatologist operator performed color Doppler sonography for pregnant women in the second trimester of pregnancy, putting the transducer above the inguinal canal directed into the para-uterine area and lower segment region. By rotating and tilting the probe toward upper and medial regions, uterine artery crossing the iliac vessels was found. The measurement of Doppler Indices was done 1 cm distally to this point. Keeping the angle of insonation < 30 degrees, pulsed Doppler gate was placed on the artery, three similar consecutive waveforms were obtained. PI and RI for each uterine artery were measured and recorded in a checklist.

At the time of delivery, data related type of delivery, neonate's 5th minute Apgar score, birth weight, gender and neonatal complications including preterm birth, IUGR, small for gestational age (SGA), hyperbilirubinemia, NICU admission and transient tachypnea of the Newborn were also recorded. A single expert perinatologist / sonographer did all routine perinatal ultrasound and color Doppler examinations until the end of pregnancy.

2-5. Statistical analysis

Data were presented as mean ± standard deviation (SD). Doppler indices and pre-postnatal outcomes between singleton and twin groups were compared using Student's t-test for continuous variables, and the Pearson $\chi 2$ test and Fisher's exact test for categorical variables. $P<0.05$ was considered as significant. The statistical software package SPSS 20.0 (SPSS Inc., Chicago, IL, USA) was used for data analyses.

2-6. Ethical considerations

All participants gave written consent and accepted in time attending for receiving routine perinatal care and delivery in our center. No extra cost was constrained on the subjects and they were assured about their right to discontinue the study course. Ethics approval for the study was obtained from the institutional review board of Tehran University of Medical Sciences (ID-code of ethics: 9211290022) according to Helsinki declaration.

3- RESULTS

Doppler examination of the uterine arteries was carried out on 71 single pregnant women and 59 women with twin pregnancy registered. Thirty one neonate in singleton and thirty six in twin pregnancies had complications. Detailed data related demographic characteristics are demonstrated in **Table.1**. Preterm delivery and SGA were significantly more frequent in twin pregnancies compared to singletons ($P<0.05$). Rates of Caesarean section (CS) were also more common in women with twin pregnancy in comparison with women with singleton pregnancy ($P<0.001$). Although there was a significant difference between two groups regarding birth weight (2632.8±741 vs. 2226±856 gr; $P=0.03$), no significant differences were observed in both groups' Apgar score and neonatal complications (**Table.2**).

Mean PI in singleton pregnancies was significantly higher than in twin pregnancies (1.4±0.8 vs. 0.6±0.2; $P<0.001$). On the other hand mean RI in twin pregnancies was significantly higher than the counterpart group (0.8±0.4, 0.6±0.2; $p=0.002$). RI and PI indices for both right and left uterine arteries are shown in **Table.3**.

Ultrasound Doppler indices were not significantly different among singleton pregnancies with and without complications ($P>0.05$). These indices were not also significantly different in twin pregnancies with and without complications (**Table.4**).

By considering cut off point as 0.62 for mean PI, sensitivity and specificity found as 70% and 47% and by considering cut off value as 0.65 for mean RI, sensitivity and specificity found as 52% and 38%. Percentiles for mean uterine artery PI for both singleton and twin pregnancies are summarized in **Table.5**.

Table-1: The demographic and pregnancy characteristics of both groups

Variables	Singleton pregnancy, n=71	Twin pregnancy, n=59
Age (year) (mean ± SD)	32.7±6.1	32.3±5.3
BMI (mean ± SD)	20.3±3.1	22.1±3.3
Level of education(year) (mean ± SD)	11.7±3.9	12.8±3.7
Diabetes, number (%)	0	1(1.6%)
HTN, number (%)	0	1(1.6%)
Preeclampsia, number (%)	4(5.6%)	1(1.6%)
Gestational diabetes, number (%)	1(1.4%)	3(4.8%)

SD: Standard deviation, HTN: Hypertension.

Table-2: The frequency of perinatal and neonatal complications in both groups

Variables	Singleton pregnancy, n=71	Twin pregnancy, n=59	P- value
Perinatal complications Preterm delivery SGA IUGR	 3 (4.2%) 1 (1.4%) 4 (5.6%)	 18 (30.5%) 17 (28.8%) 7 (11.8%)	 <0.001 <0.001 0.2
Mode of delivery NVD C/S	 11 (15.4%) 60 (84.5%)	 3 (5%) 56 (95%)	<0.001
Neonatal complications Hyperbilirubinema TTN NICU admission	 17 (23.9%) 0 14 (19.7%)	 23 (39%) 3 (5.1%) 10 (16.9%)	0.07
Placental abruption	1 (1.4%)	0	0.08
5th Minute Apgar score (mean ± SD)	9.3±0.8	8.9±1	0.06

SGA: Small for gestational age; IUGR: Intra uterine growth restriction; NVD: Normal vaginal delivery; CS: Cesarean section; TTN: Transient tachypnea of the newborn; SD: Standard deviation.

Table-3: The Ultrasound Doppler indices in the both groups

Variables	Singleton pregnancy, n=71	Twin pregnancy, n=59	P- value
Right uterine artery PI	1.4±1	0.6±0.2	<0.001
Right uterine artery RI	0.6±0.3	0.8±0.4	0.002
Left uterine artery PI	1.4±1	0.6±0.2	<0.001
Left uterine artery RI	0.7±0.3	0.8±0.4	0.03

PI: Pulsatility index; RI: Resistive index.

Table-4: The Ultrasound Doppler indices in singleton and twin pregnancies with and without complications

Variables	With complications	Without complications	P-value
Singletons			
RUA* PI	1.6±1.2	1.3±0.8	0.2
RUA RI	0.6±0.2	0.6±0.4	0.5
LUA** PI	1.5±0.9	1.4±1.1	0.7
LUA RI	0.6±0.3	0.7±0.3	0.5
Mean PI	1.5±0.9	1.3±0.7	0.3
Mean RI	0.6±0.2	0.6±0.2	0.3
Twins			
RUA PI	0.6±0.2	0.6±0.2	0.9
RUA RI	0.9±0.4	0.7±0.4	0.3
LUA PI	0.5±0.2	0.6±0.2	0.3
LUA RI	0.8±0.3	0.9±0.5	0.4
Mean PI	0.5±0.2	0.6±0.2	0.5
Mean RI	0.8±0.3	0.8±0.5	0.8

*Right uterine artery; **Left uterine artery.

Table-5: Percentiles for mean uterine artery PI

Groups	25^{th} percentile	50^{th} percentile	75^{th} percentile	95^{th} percentile
Singleton	0.93	1.2	1.9	3.3
Twin	0.48	0.54	0.65	1.2

4- DISCUSSION

The findings of this study demonstrate that, the mean PI of uterine arteries in singleton pregnancies was significantly higher than in twin group. We also found that the mean of uterine artery PI in both singleton and twin pregnancies were not significantly different between complicated and uncomplicated groups. In accordance to our results, Rizzo et al. reported a higher median uterine artery PI in singleton pregnancies than in twin cases (1 vs. 0.8), but in consistent to our results, they found a higher PI index in complicated pregnancies (14). Klein et al. have also indicated a lower PI of uterine arteries in twin pregnancies compared with singletons (15). Jamal et al. have indicated that the mean PI of singleton pregnancies in second trimester was 1.03. This index among complicated group was significantly higher than in uncomplicated group (1.27 vs. 0.99, p= 0.003) (2). In our study sensitivity of uterine artery PI for adverse pregnancy outcomes was 70%; while Jamal et al. demonstrated a lower rate by 33% (2). In previous studies, sensitivity of uterine artery for predicting adverse pregnancy outcomes ranged between 20% and 60% (16-18). By evaluating of singleton pregnancies, Afrakhteh et al. indicated that the mean PI value was 1.1 in normal pregnancies and 1.5 in complicated cases (3). Contrary to our expectations, the rates of perinatal complications were not different between singleton and twin groups. This result may be due to our sample size and considering few but not all perinatal complications with different prevalence. We performed color Doppler sonography for pregnant women in the second trimester of pregnancy. Jamal et al. also suggested performing of Doppler ultrasound in the second trimester. Cases with abnormal

Doppler findings in the second trimester should be evaluated in the third trimester. Repeated abnormal findings in the third trimester may show the increased risk of perinatal adverse outcome (2). Afrakhteh et al. have also demonstrated a higher sensitivity for UTA PI (predicting adverse outcomes) in the second trimester than third trimester (3). Screening ability of uterine artery ultrasound in the second trimester predicting adverse outcomes had been evaluated previously (19, 20). Singh et al. claimed an increased PI of uterine artery in the second trimester as an important predictor of still birth (19). Coleman et al. assessed development of preeclampsia and SGA by evaluating uterine artery Doppler indices. They included only high risk women and showed that uterine artery Doppler waveform analysis was the best predictor of severe adverse outcome (21).

Although we found no difference between uterine artery RI in complicated and normal pregnancies, Afrakhteh et al. showed a higher uterine artery RI in complicated pregnancies. Trophoblast invasion to spiral arteries makes these arteries as channels for blood exchange. The impedance to flow in the uterine arteries decreases between 6-24 weeks of gestation (22, 23). Impaired placental invasion leading higher resistance, can result increase in uterine artery PI (15).

Lower PI values, different maternal hemodynamics and larger placental implantation are observed in twin pregnancies. Alteration in Doppler indices could predict higher risk of adverse pregnancy outcomes such as preeclampsia although the sensitivity of Doppler ultrasound exam in twin pregnancies is less than singletons (24). This study had some limitations. First, we did not include all perinatal complications. Second, we conducted this study in a tertiary hospital. Larger multi centric studies are strongly recommended.

5- CONCLUSION

According the results, the mean uterine arteries PI in twin pregnancies in the second trimester were lower than singleton pregnancies. On the other hand, the mean PI value did not differ between perinatal complicated and uncomplicated pregnancies.

6- AUTHOR'S CONTRIBUTION

Dr. Rahimi Sharbaf and Teimoory carried out the design and coordinated the study, participated in most of the experiments. Dr Moshfeghi and Niroomanesh coordinated and carried out all the experiments, Analysis of data and participated in manuscript preparation. Dr. Shirazi and Naemi provided assistance for all experiments and prepared the manuscript. All authors have read and approved the content of the manuscript.

7- CONFLICT OF INTEREST: None.

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