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Relationship between Maternal Age and Uterine Artery Doppler Flow during Second Trimester

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Abstracts

Objective: To determine the relationship between maternal age and uterine artery Doppler flow during second trimester in normal pregnancy.

Material and Method: Uterine artery Doppler screening was performed as a part of second trimester screening in singleton normal pregnant women at Maternal Fetal Medicine unit, Thammasat University Hospital between January 2011 and May 2012. Pulsatility index (PI), resistance index (RI) and systolic-diastolic ratio (S/D ratio) were measured from each uterine artery. Mean PI, RI and S/D ratio of the two vessels was calculated. Regression analysis was performed to determine the relationship between maternal age and uterine artery PI, RI and S/D ratio values.

Results: Doppler ultrasound examinations of both uterine arteries were performed in 247 singleton pregnancies. There was no correlation of maternal age and uterine artery PI, RI and S/D ratio.

Conclusions: In normal pregnancy, second trimester uterine artery Doppler waveform analysis was not affected by maternal age.

Keywords: Doppler, Uterine artery, Maternal age

Introduction

Recently, numerous studies of Doppler ultrasound assessment of both maternal and fetal circulations for evaluation of high-risk pregnancy have been conducted⁽¹⁻⁵⁾. Uterine artery is one of the vessels that has been investigated for the prediction of pregnancy outcomes and this artery could demonstrate the relationship between maternal and fetal circulation⁽⁶⁻¹²⁾. Abnormal uterine artery Doppler flow associated with adverse pregnancy outcomes. Nevertheless, the definition of abnormal uterine artery Doppler flow was different in many

studies^(7, 10, -11, 13). Some authors defined abnormal uterine Doppler flow as present diastolic notches and/or uterine PI or RI above 95th percentile for gestational age^(10,13) but some studies defined abnormal uterine Doppler flow as PI was above 1.58^(6,14). Furthermore, advanced maternal age is a known risk factor for adverse pregnancy outcomes. There are studies establishing the relationship between maternal age and uterine artery impedance but the results were discordancy⁽¹⁵⁻¹⁶⁾. If uterine artery impedance was affected by maternal age, the study of uterine artery Doppler flow for predicting adverse pregnancy outcomes

should be corrected with maternal age. Thus, the aim of this study was to determine whether maternal age affects uterine artery Doppler flow in normal second trimester pregnancy.

Material and Method

The prospective cohort of pregnant women aged between 20-40 years were recruited into the study at Maternal-Fetal Medicine unit, Thammasat University Hospital between January 2011 and May 2012. This study was approved by the Ethics Committee of the Faculty of Medicine, Thammasat University. Doppler ultrasound assessments of both uterine arteries were performed by staffs of maternal fetal medicine unit in 247 normal singleton pregnant women during 14-28 weeks gestation. Maternal ages of 20-40 years old were recruited. Gestational age was calculated from the first day of the last normal menstrual period and confirmed by either first-or early second-trimester ultrasound scan. All cases with known chromosomal abnormalities, structural abnormalities, intrauterine growth restriction or maternal medical diseases were excluded. The right and left uterine arteries were identified at the apparent crossover with the external iliac artery using color Doppler flow. Pulsed-wave Doppler was performed to obtain uterine artery waveforms using a Voluson 730 Expert (GE medical system, USA) ultrasound machine. When three to five similar consecutive waveforms were demonstrated, the

pulsatility index (PI), resistance index (RI), systolic-diastolic velocity ratio (S/D ratio), mean PI, RI and S/D ratio of the two vessels were calculated. Regression analysis was performed to show the relationship between maternal age and uterine artery PI, RI and S/D ratio values using the SPSS Version 14 for Windows.

The sample size was calculated by the following formula⁽¹⁷⁾

$$n = \frac{Z^2pq}{d^2}$$

$$p = 0.5$$

$$d = 0.1$$

$$n = \frac{(2.58)^2 (0.5)(0.5)}{(0.1)^2}$$

$$= 166.41$$

Results

Two hundred and forty-seven pregnancies completed this study. Two hundred and six women (83.40%) were elderly pregnancy (maternal age \geq 35 years). The demographic data was presented in Table 1. Gestational age, gravidity and parity were not different between both groups. The relationship between maternal age and mean PI, RI and SD ratio of uterine artery are shown in Fig. 1- 3. There was no correlation between maternal age and uterine artery Doppler flow parameters.

Table 1. Maternal demographic data

Variables	Maternal age < 35 years (n=41)	Maternal \geq 35 years (n=206)	p
Age (mean \pm SD)	29.83 \pm 4.31	37.38 \pm 1.74	0.000*
Gestational age (weeks \pm SD)	20.39 \pm 2.38	19.64 \pm 1.76	0.059*
Gravidity (cases)			0.201**
1	28	165	
2	11	37	
3	2	4	

Variables	Maternal age < 35 years (n=41)	Maternal age ≥ 35 years (n=206)	p
Parity (cases)			0.723**
0	34	171	
1	6	33	
2	1	2	

* t- test; ** Chi-square test; p < 0.05 is defined as significant

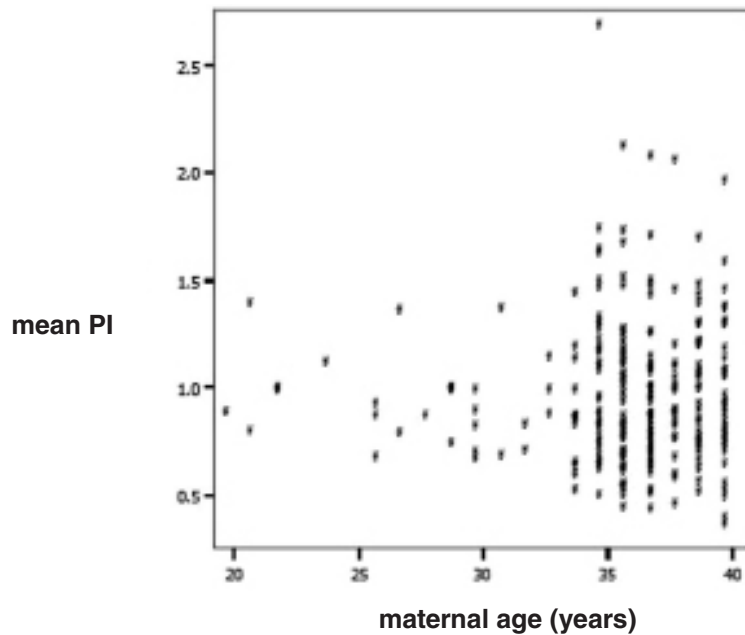


Fig. 1. The relationship of pulsatility index versus maternal age

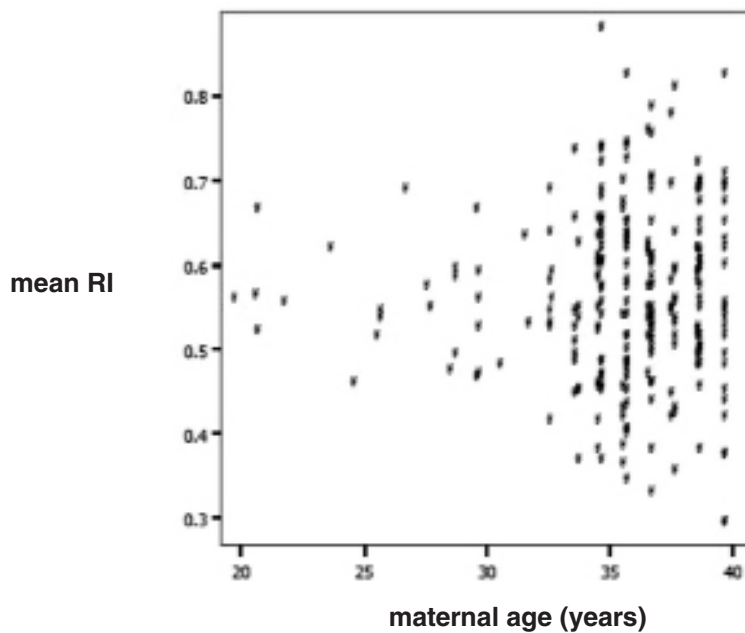


Fig. 2. The relationship of resistance index versus maternal age

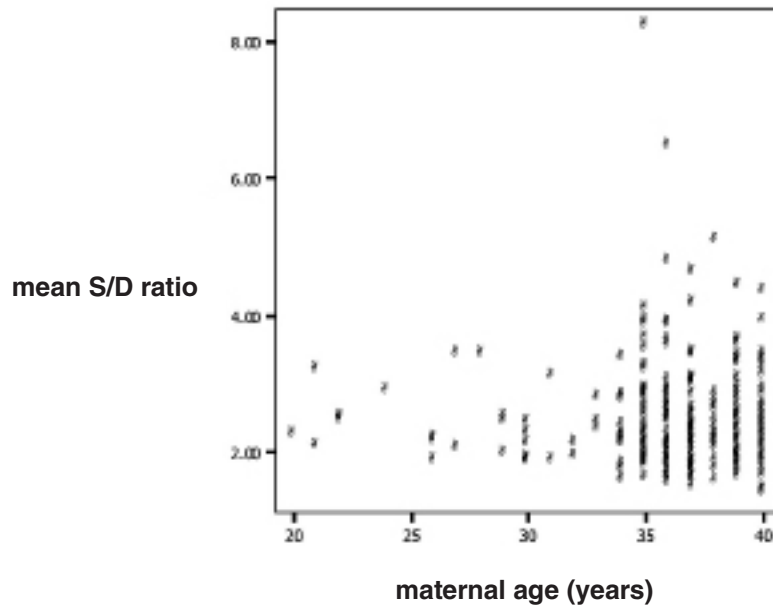


Fig. 3. The relationship of systolic-diastolic ratio versus maternal age

Comparing of elderly pregnancy and younger group, the mean PI, RI and S/D ratio were not different as shown in Table 2.

Table 2. Doppler parameters (mean and standard deviation) of uterine artery by maternal age groups

Doppler parameters	Mean \pm standard deviation		95% Confidence interval of the mean difference	p
	Maternal age < 35	Maternal age \geq 35		
	years (n = 41)	years (n = 206)		
Pulsatility index (PI)	0.89 \pm 0.22	0.96 \pm 0.36	- 0.15 – 0.02	0.13
Resistance index (RI)	0.54 \pm 0.07	0.56 \pm 0.11	- 0.04 – 0.01	0.35
Systolic-diastolic ratio (S/D ratio)	2.33 \pm 0.47	2.49 \pm 0.84	- 0.42 – 0.11	0.24

* t- test; p < 0.05 is defined as significant

Discussion

Advanced maternal age with impaired uteroplacental blood flow as reflected by abnormal uterine artery Doppler flow velocities remain the important causes of severe pregnancy complications, such as pre-eclampsia and intrauterine growth restriction. According to several studies^(6-14,16), abnormal uterine artery impedance as the presence of bilateral

uterine arteries notching, PI or RI over the 95th percentile, or both related with adverse pregnancy outcomes (severe pre-eclampsia or intrauterine growth restriction). Thus, uterine artery Doppler study could be used for screening and predicting the adverse pregnancy outcomes. The normal physiological process of trophoblastic invasion was demonstrated by observation from Doppler ultrasound studies that

impedance of flow in the uterine arteries decreased with gestation from 6 to 24 weeks and remained constant thereafter⁽¹⁸⁻¹⁹⁾. There were some studies showed the relationship between maternal age and uterine artery Doppler flow⁽¹⁵⁾. Maternal aging might lead to numerous changes in the uterus and placenta. The uterine blood flow has been found to decrease as maternal age advances⁽¹⁵⁾.

In this study, no correlation between maternal age and uterine artery PI, RI and S/D ratio in normal pregnancy was demonstrated. The uterine artery PI, RI and S/D ratios were not different in younger and elderly groups. Thus, conclusion from this study, uterine artery Doppler flow does not correlated with maternal age.

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ความสัมพันธ์ระหว่างอายุของสตรีตั้งครรภ์และการไหลเวียนเลือด ของหลอดเลือดแดง uterine ในช่วงไตรมาสที่สองของการตั้งครรภ์

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วัตถุประสงค์ : เพื่อศึกษาว่าความสัมพันธ์ระหว่างอายุของสตรีตั้งครรภ์ปกติและการไหลเวียนเลือดของหลอดเลือดแดง uterine ในช่วงไตรมาสที่สองของการตั้งครรภ์

วิธีการ : สตรีตั้งครรภ์ปกติที่ได้รับการตรวจด้วยคลื่นเสียงความถี่สูงที่หน่วยเวชศาสตร์มารดาและทารกในครรภ์ โรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ ขณะอายุครรภ์ 14-28 สัปดาห์ ในช่วงระหว่างเดือนมกราคม พ.ศ. 2554 ถึง เดือน พฤษภาคม พ.ศ. 2555 จะได้รับการตรวจคลื่นเสียงดอปเปลอร์หลอดเลือดแดง uterine ทั้ง 2 ข้างเพื่อวัดค่า PI, RI, SD ratio และหาค่าเฉลี่ยของการวัดจากทั้ง 2 ข้าง วิเคราะห์ความสัมพันธ์ระหว่างอายุและค่าต่างๆ โดยวิธี regression analysis

ผลการศึกษา : สตรีตั้งครรภ์ 247 รายเข้าร่วมในการศึกษานี้ ไม่พบความสัมพันธ์ของอายุของสตรีตั้งครรภ์และค่า PI, RI และ SD ratio ของหลอดเลือดแดง uterine

สรุป : ในไตรมาสที่สองของการตั้งครรภ์ไม่พบความสัมพันธ์ของอายุของสตรีตั้งครรภ์และการไหลเวียนเลือดของหลอดเลือดแดง uterine
