นิพนธ์ต้นฉบับ

Uterine artery Doppler flow in advanced maternal age at 17-24 weeks of gestation

Tongta Nanthakomon, Athita Chanthasenanont, Charintip Somprasit

Abstract

Objective: To present the Doppler flow of uterine artery for gestational age in early second trimester in advanced maternal age compared with low risk young pregnant women.

Methods: 132 singleton pregnant women with age at least 35 years old were enrolled as advanced maternal age group. 87 normal singleton pregnant women younger than 35 year old defined as control group. The uterine artery pulsatility indices (PI), resistance indices (RI), systolic/diastolic ratio (SD ratio), maximum velocity (Vmax) and presence of diastolic notch of both sides were recorded. The SPSS software version 13.0 was used to create graphs of both side uterine arteries Doppler flow throughout gestational age in second trimester of both groups.

Results: The distribution of uterine artery PI, RI and SD ratio at gestational age 17-24 weeks of elderly pregnant women were higher than young pregnant women statistically significant. However, presence of uterine artery notch of both groups did not have significant differences.

Conclusions: Uterine artery PI, RI and SD ratio for gestational age in early second trimester in advanced maternal age are higher than low risk young pregnant women. These findings show increase uterine artery impedance in women above the aged of 35.

Key words: Advanced maternal age, Doppler, Uterine artery

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Introduction

Advanced maternal age is known as a predispose factor of many obstetrics complications as intrauterine growth restriction, preterm, gestational diabetes, chronic hypertension and pre-eclampsia.[1,2] Recently, there are many studies to show Doppler evaluation to predict obstetrics complication for either arterial or venous blood flow.[3-8]

The uterine artery Doppler flow is one of blood vessels that had been investigated the correlation with adverse perinatal outcomes[7, 9-14] and assessment of uteroplacental circulation. Abnormal uterine arteries Doppler flow reflects increased impedance in the uterine circulation. Nevertheless, the abnormal uterine artery blood flow was defined in a different definition and reference values.[9,12,13,15] Because advanced maternal age is one of the risk factors of obstetrics complications that relates with decrease in uteroplacental blood flow or increase in uterine impedance as intra uterine growth restriction and pre-eclampsia. The authors have a suspicion that advanced maternal age might have uterine artery blood flow different from young low risk pregnant women.

Therefore, the aim of the present study was to demonstrate whether the uterine artery Doppler flow in early second trimester in elderly gravidarum is different from low risk pregnancy.

Material and Method

In this prospective cross sectional study, uterine arteries Doppler ultrasound was performed on 219 singleton pregnant women who attended the Maternal Fetal Medicine Unit, Department of Obstetrics and Gynecology, Thammasat University between January 2010 - June 2010. There were 132 cases of pregnancy of 35 years and older and 87 cases of pregnant women younger than 35 year old. Pregnant women of 35 years and older defined as study group and pregnancy of younger than 35 year old defined as control group. The present study was approved by the Ethics Committee of the Faculty of Medicine, Thammasat University. Exclusion criteria were multiple pregnancies, pregnancy with fetal anomalies, pregnant women with serious medical disease, diabetes mellitus, smoking, alcohol consumption or drug addiction. Gestational age was identified by last menstrual period and then confirmed by ultrasound biometry measurement. After gestational age was confirmed and fetal anomaly was scanned, uterine arteries Doppler waveforms were obtained using Voluson E8 Expert ultrasound machine 3.5 or 5 MHz. transducer was placed on left and right lower quadrant of the maternal abdominal wall to identify the external iliac arteries and the uterine artery medial to it flow velocity waveforms were obtained from each uterine artery near to the external iliac artery, before division if the uterine artery into branches.[16] Recordings were performed in the absence of fetal breathing or movements. Uterine artery pulsatility index (PI), resistance index (RI), systolic/diastolic ratio (SD ratio) and maximum velocity (Vmax) were calculated from three even subsequent blood flow velocity waveforms. Presence or absence of an early diastolic notch was recorded.

The uterine artery PI, RI, SD ratio and Vmax for each gestational age in each group were calculated using SPSS software package version 13.0 for Windows (SPSS Inc, Chicago, III, USA) and expressed in 5^{th}, 50^{th} and 95^{th} percentile. Linear regression of gestational age and PI, RI, SD ratio and Vmax with r^2 were present.

Results

The study included 87 control cases and 132 elderly pregnant women. The mean gestational age of control and elderly group were 20.64 and 19.65 weeks, respectively. The demographic data was present in Table 1. Number of cases in each group for each gestational age was present in Table 2.

Table 1 Demographic data of both groups

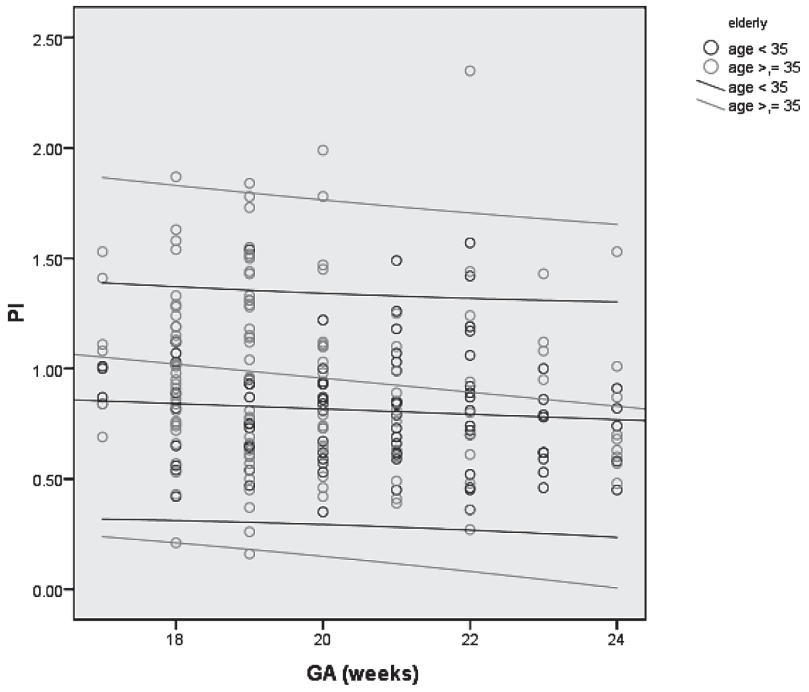
Characteristics	Age < 35 year (n = 87)	Age ≥ 35 year (n = 132)
Maternal age		
Mean ± SD (years)	27.86 ± 4.62	38.29 ± 2.85
Range (years)	17-34	35-49
Gestational age		
Mean ± SD (weeks)	20.64 ± 1.81	19.65 ± 1.85
Range (weeks)	17-24	17-24
Estimated fetal weight		
Range (grams)	212-777	172-863

Table 2 Number of cases in each gestational age

Gestational age (complete weeks)	Age < 35 year (n = 87)	Age ≥ 35 year (n = 132)
17	3	7
18	9	34
19	13	36
20	15	21
21	17	11
22	16	10
23	9	4
24	5	9

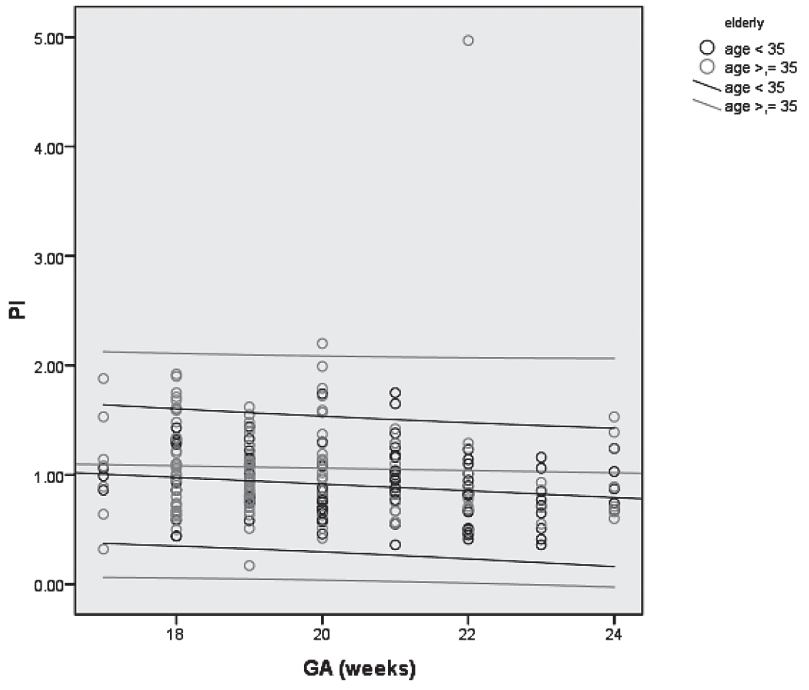
The distribution of PI of the right and left uterine arteries at 17-24 weeks gestation of both control group and elderly pregnant women are shown in Fig. 1, 2. The authors also presented the 5^{th}, 50^{th} and 95^{th} percentile for gestational age. The uterine artery PI was linear decreased across gestation (right uterine artery PI = 1.569 - (0.033 × GA), r^2 = 0.030, p = 0.011 and left uterine artery PI = 1.690-(0.035 × GA), r^2 = 0.032, p = 0.008). The curve-fitted percentile charts of right and left uterine arteries RI of both groups were created (Fig. 3, 4). The uterine artery RI was linear decreased across gestation (right uterine artery RI = 0.810 - (0.013 × GA), r^2 = 0.033, p = 0.007 and left uterine artery RI = 0.830 - (0.012 × GA), r^2 = 0.024, p = 0.022).

The systolic/ diastolic ratio of right and left uterine arteries were presented. It showed in a linear relationship along gestational age (Fig. 5, 6) (right uterine artery SD ratio = 4.240 - (0.092 × GA), r^2 = 0.041, p = 0.003 and left uterine artery SD ratio = 5.192 - (0.126 × GA), r^2 = 0.047, p = 0.001). Maximum velocities of the right and left uterine arteries were presented (Fig. 7, 8). It presented a nonlinear relation with gestational age; differed from other Doppler flows (right uterine artery Vmax = 43.510 + (1.096 × GA), r^2 = 0.005, p = 0.304 and left uterine artery Vmax = 33.573 + (1.848 × GA), r^2 = 0.015, p = 0.068).



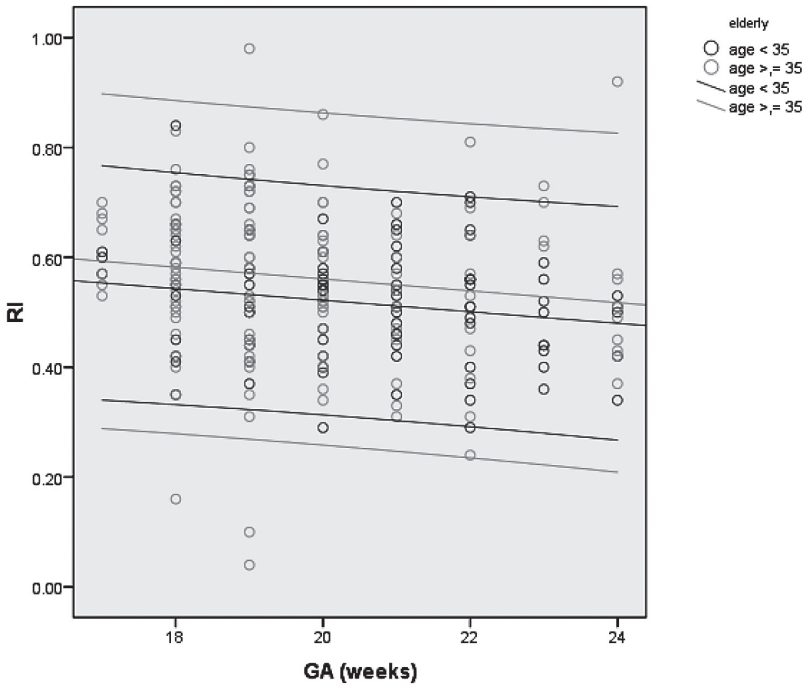
PI; pulsatility index, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 1 Pulsatility indices of the right uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile



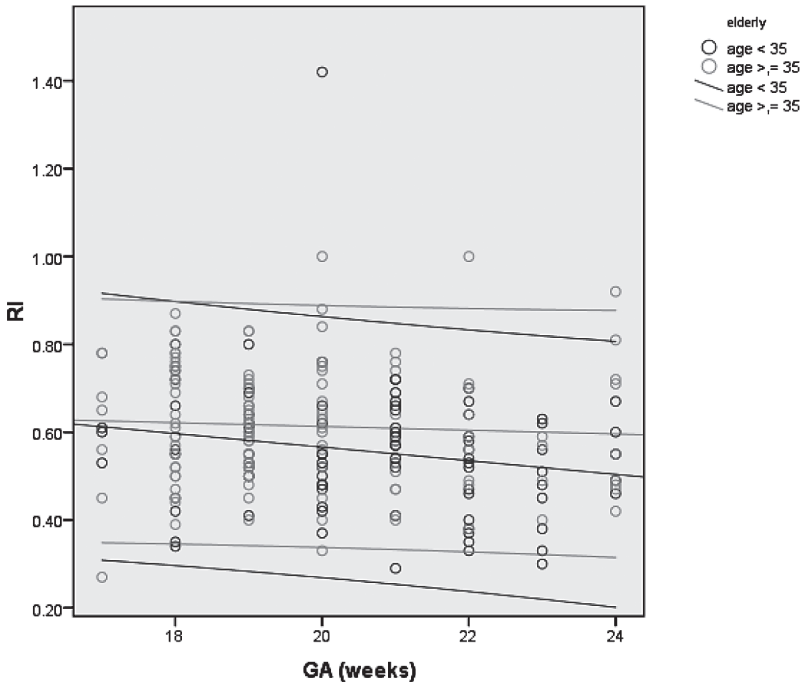
PI; pulsatility index, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 2 Pulsatility indices of the left uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile



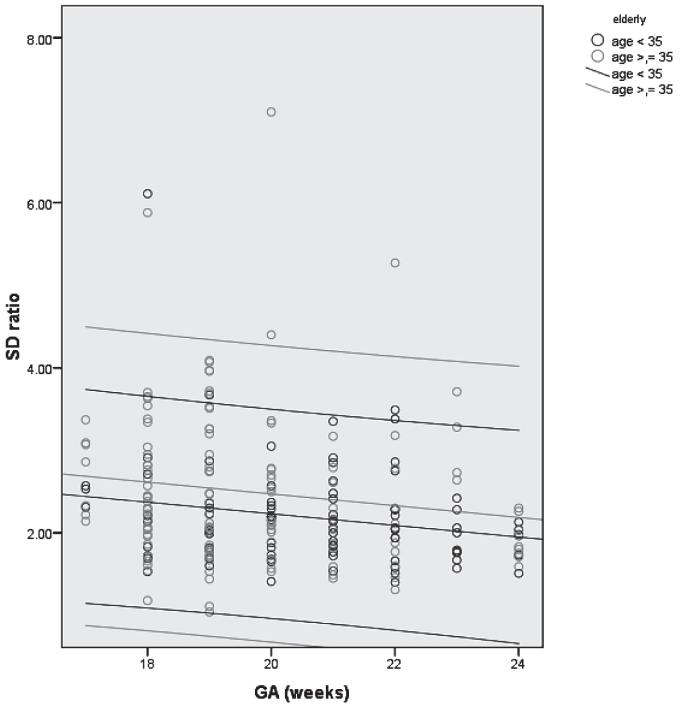
RI; resistance index, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 3 Resistance indices of the right uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile



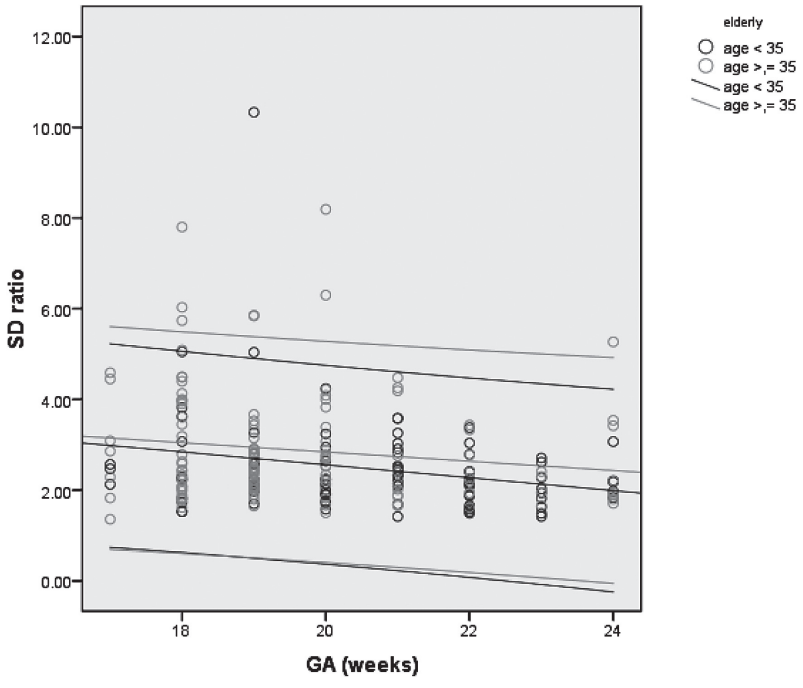
RI; resistance index, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 4 Resistance indices of the left uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile



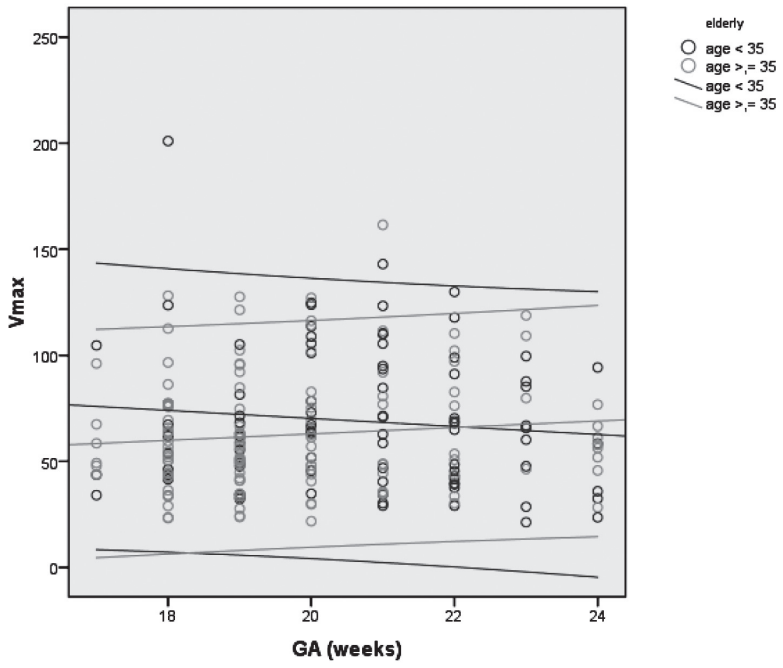
SD ratio; systolic/diastolic ratio, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 5 Systolic/diastolic ratios of the right utery artery in control and study group at 17-24 weeks gestation; the $5^{th,}$ 50^{th} and 95^{th} percentile



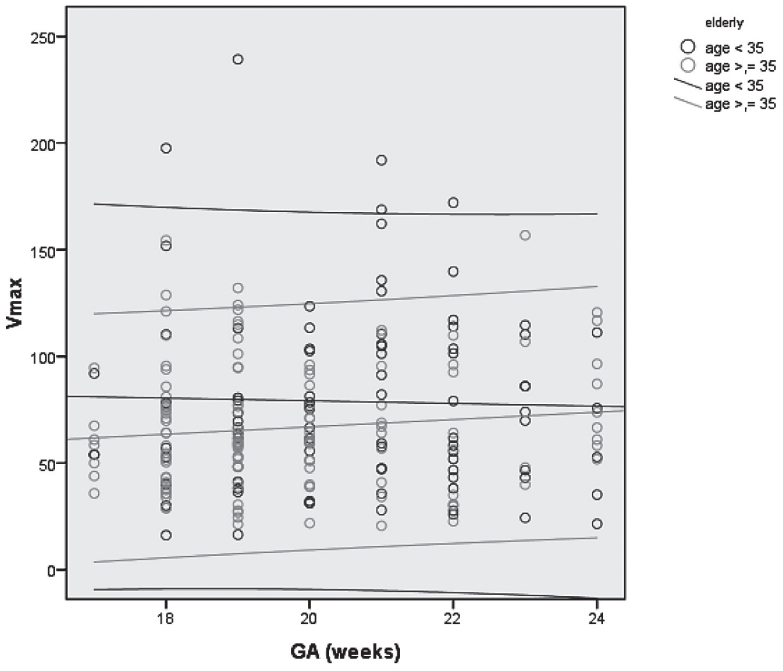
SD ratio; systolic/diastolic ratio, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 6 Systolic/diastolic ratios of the left uterine artery in control and study group at 17-24 weeks gestation; the 5^{th}, 50^{th} and 95^{th} percentile



Vmax; maximum velocity, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 7 Maximum velocities of the right uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile



Vmax; maximum velocity, GA; gestational age, o; age < 35 years, o; age ≥ 35 years

Fig. 8 Maximum velocities of the left uterine artery in control and study group at 17-24 weeks gestation; the 5th, 50th and 95th percentile

Mean of uterine artery Doppler flow of both elderly maternal age group and control group were present in Table 3. Mean of uterine arteries PI, RI and SD ratio in advanced maternal age were higher than low risk young pregnant women significantly. Presence of early diastolic notch of uterine arteries was present in Table 4. There was no statistically significant difference between both groups.

Table 3 Comparisons of mean of uterine arteries pulsatility indices (PI), resistance indices (RI), systolic/diastolic ratio (SD ratio) and maximum velocity (Vmax) between control group and study group

Doppler flow	Mean of Doppler flow		*p value**
	Age < 35 year (n = 87) Mean ± SD (range)	Age ≥ 35 year (n = 87) Mean ± SD (range)	
Right uterine PI	0.80 ± 0.26 (0.35-1.57)	0.96 ± 0.40 (0.16-2.35)	0.002*
Right uterine RI	0.51 ± 0.10 (0.29-0.84)	0.56 ± 0.15 (0.64-0.98)	0.009*
Right S/D ratio	2.18 ± 0.64 (1.4-6.11)	2.95 ± 5.26 (1.04-62.05)	0.001*
Right Vmax	72.39 ± 42.70 (21.30-325)	62.43 ± 26.95 (21.80-161.50)	0.062
Left uterine PI	0.89 ± 0.31 (0.36-1.75)	1.06 ± 0.51 (0.17-4.97)	0.004*
Left uterine RI	0.55 ± 0.15 (0.29-1.42)	0.61 ± 0.13 (0.27-1.00)	0.003*
Left S/D ratio	2.46 ± 1.11 (1.42-10.33)	2.88 ± 1.23 (1.36-8.19)	0.001*
Left Vmax	78.78 ± 93.94 (26.14-239.3)	66.38 ± 29.13 (20.61-156.8)	0.087

PI; pulsatility index, RI; resistant index, SD ratio; systolic/diastolic ratio, Vmax; maximum velocity;

* Chi-square test : $p < 0.05$; significant

Table 4 Presence of early diastolic notch of uterine arteries in both groups

Uterine artery	Number of cases (percent)		*p value**
	Age < 35 year (n = 87)	Age ≥ 35 year (n = 132)	
Right uterine artery notch	18 (20.7)	19 (14.4)	0.302
Left uterine artery notch	16 (18.4)	18 (13.6)	0.447

* Chi- square test : $p < 0.05$; significant

Discussion

Several Doppler flow studies have investigated the correlation of maternal age on uterine arteries.[17] Some studies found no evidence of increased uterine vascular impedance with patient age.[18-19] But the present study shows significant higher PI, RI and SD ratio in elderly pregnant women compared to young pregnant women as Pirhonen's study.[17] Maximum velocities of uterine artery in elderly group appeared higher than young pregnant women but did not have statistically significant difference. It might have been to limitation of sample size. The higher Doppler flow of uterine artery in elderly group presents the increase impedance in the uterine circulation which could be seen normally in elderly pregnancy.[17] Early diastolic notches can be a physiologic finding in second trimester.[15] The prevalence of diastolic notches in the present study is the same as previous reports.[20] The frequency of diastolic notches in both elderly and young groups is not different significantly. It may be from the insufficiently number of cases.

This finding may be related to the physiologic process of aging and may partly explain why pregnancies in older women are associated with diverse complications more often than those in younger women. Thus, the abnormal uterine artery blood flow in elderly might be used for reference values for advanced maternal age. Nonetheless, further investigation of the clinical value for prediction of poor perinatal outcomes by using uterine Doppler flow with reference values for elderly may be need.

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บทคัดย่อ

การตรวจด้วยคลื่นเสียงความถี่สูงดอพเลอร์หลอดเลือดแดงมดลูกในหญิงตั้งครรภ์ที่มีอายุตั้งแต่ ๓๕ ปี ขึ้นไป ขณะมีอายุครรภ์ ๑๗-๒๔ สัปดาห์

ต้องตา นันทโกมล, อธิตา จันทเสนานนท์, จรินทร์ทิพย์ สมประสิทธิ์

หน่วยเวชศาสตร์มารดาและทารกในครรภ์ ภาควิชาสูติศาสตร์-นรีเวชวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์

วัตถุประสงค์: เพื่อศึกษาการไหลเวียนเลือดของหลอดเลือดแดงมดลูก โดยการตรวจด้วยคลื่นเสียงความถี่สูงดอพเลอร์ ในหญิงตั้งครรภ์ที่มีอายุตั้งแต่ ๓๕ ปีขึ้นไป เปรียบเทียบกับหญิงตั้งครรภ์อายุน้อยที่มีความเสี่ยงต่ำ ในช่วงไตรมาสที่สองของการตั้งครรภ์

วัสดุและวิธีการ: ได้ทำการตรวจคลื่นเสียงความถี่สูงดอพเลอร์หลอดเลือดแดงมดลูก ในหญิงตั้งครรภ์เดี่ยวที่มีอายุตั้งแต่ ๓๕ ปีขึ้นไป จำนวน ๑๓๒ ราย เปรียบเทียบกับหญิงตั้งครรภ์เดี่ยว ที่มีอายุน้อยกว่า ๓๕ ปี จำนวน ๘๗ ราย ค่า pulsatility indices (PI), resistance indices (RI), systolic/diastolic ratio (SD ratio), maximum velocity (Vmax) และการมี diastolic notch ของหลอดเลือดแดงมดลูกทั้งสองข้างได้ถูกบันทึกและเปรียบเทียบระหว่างสองกลุ่ม

ผลการศึกษา: ค่า PI, RI และ SD ratio ของหญิงตั้งครรภ์ที่มีอายุมากกว่า ๓๕ ปี สูงกว่า หญิงตั้งครรภ์อายุน้อย อย่างมีนัยสำคัญทางสถิติ อย่างไรก็ตาม พบว่า การมี diastolic notch ของทั้งสองกลุ่ม ไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ

สรุป: ในไตรมาสที่สองของการตั้งครรภ์ พบว่า ค่า PI, RI และ SD ratio ของหญิงตั้งครรภ์ที่มีอายุมากกว่า ๓๕ ปี สูงกว่า หญิงตั้งครรภ์อายุน้อย ซึ่งแสดงให้เห็นว่า ในหญิงตั้งครรภ์ที่มีอายุตั้งแต่ ๓๕ ปีขึ้นไป มีความต้านทานของหลอดเลือดแดงมดลูกสูงขึ้น

คำสำคัญ: หญิงตั้งครรภ์อายุมากกว่า ๓๕ ปี, คลื่นเสียงความถี่สูงดอพเลอร์, หลอดเลือดแดงมดลูก