



ELSEVIER

GENERAL OBSTETRICS AND GYNECOLOGY: OBSTETRICS

# Change in pulse wave velocity throughout normal pregnancy and its value in predicting pregnancy-induced hypertension: A longitudinal study

Mizuho Oyama-Kato, MD, Masahide Ohmichi, MD, PhD,\* Kazuhiro Takahashi, MD, PhD, Sachiko Suzuki, Noriko Henmi, MD, Yukio Yokoyama, MD, PhD, Hirohisa Kurachi, MD, PhD

*Department of Obstetrics and Gynecology, Yamagata University School of Medicine, Iidanishi, Yamagata, Japan*

Received for publication June 30, 2005; revised January 17, 2006; accepted January 27, 2006

## KEY WORDS

PWV

Arterial stiffness

Pregnancy

Pregnancy-induced  
hypertension

**Objective:** We longitudinally examined the changes of brachial to ankle distensibility using pulse wave velocity (PWV) throughout pregnancy and its difference between normal pregnancy and pregnancy-induced hypertension (PIH) groups.

**Study design:** One hundred and eighty-three pregnant women were included in this study. The PWV examinations were performed in a longitudinal way during the first, second, and third trimesters of pregnancy, and immediately and 1 month after delivery.

**Results:** In normal pregnancies, the PWV significantly decreased at the second trimester, increased from the third trimester through immediately after delivery, and decreased again at 1 month after delivery. In PIH patients, it increased in proportion to the progression of gestation.

**Conclusion:** We monitored the longitudinal changes in PWV and constructed a PWV normogram during pregnancy. The predictive value of PWV and blood pressure for PIH was higher than that of blood pressure alone, suggesting the usefulness of measuring PWV to predict PIH.

© 2006 Mosby, Inc. All rights reserved.

Supported in part by a Grant-in-Aid for Exploratory Research, No. 16659444 (H.K.), and for Young Scientists, No. 16790936 (A.M.-A.) from the Ministry of Education, Culture, Sports, Science and Technology of Japan, and in part by a Grant-in-Aid for Scientific Research, No. 16591636 (K.T.), and for the 21st century Center of Excellence (COE) Program from the Japan Society for the Promotion of Science, and in part by a Grant-in-Aid for Research on Health Sciences focusing on Drug Innovation from the Japan Health Sciences Foundation.

\* Reprint requests: Dr Masahide Ohmichi, Department of Obstetrics and Gynecology, Yamagata University School of Medicine, 2-2-2, Iidanishi, Yamagata, Yamagata, 990-9585, Japan.

E-mail: [masa@med.id.yamagata-u.ac.jp](mailto:masa@med.id.yamagata-u.ac.jp)

During normal pregnancy, both the maternal total blood volume and the cardiac output increase markedly. The increase in maternal total blood volume begins during the first trimester, and reaches a plateau at the beginning of the third trimester. Cardiac output rises by 40% to 50% above nonpregnant values. Because of hemodynamic adaptations, however, arterial blood pressure decreases during the first and middle trimesters of pregnancy.<sup>1</sup> On the other hand, because of a lack of appropriate adaptation of hemodynamics, arterial blood pressure increases in pregnancy-induced hypertension

(PIH).<sup>2</sup> However, the precise mechanisms of these phenomena remain unknown.

Recent advances in ultrasonography have made possible the detection of atherosclerotic events.<sup>3</sup> Flow-mediated dilatation (FMD) is an established index for evaluating endothelial function. FMD tends to increase during normal pregnancy,<sup>4</sup> suggesting that the enhancement of nitric oxide production in normal pregnancy may contribute to the decrease in peripheral resistance.<sup>5,6</sup> FMD decreased in PIH,<sup>7,8</sup> indicating that endothelial dysfunction plays a role in the pathophysiology of PIH. However, there are several pathological features of PIH in addition to endothelial dysfunction. It was reported that PIH is associated with increased cerebral arterial wall stiffness.<sup>9</sup> Although FMD is not affected by arterial structure (elastic fibers or collagen), pulse wave velocity (PWV) reflects tunicamedia function and is affected by pathohistological changes of arterial structure.<sup>10-12</sup> For measuring PWV, estimating the aortic PWV by measuring the carotid and femoral distensibility has been used. However, this is an invasive procedure, complex and time consuming, and it requires a specially qualified operator.<sup>13</sup> Recently, a new automatic device has been developed for measuring brachial-to-ankle PWV (baPWV), which was shown to have a good correlation with aortic PWV, by measuring the brachial and tibial distensibility.<sup>11</sup> This method is non-invasive and rapid, and the repeatability is good.<sup>11</sup> In addition, the simplicity of this method is well-suited for use in screening large populations.

There have been only a few reports which examined PWV during pregnancy cross-sectionally. There also have been only a few longitudinal reports about PWV throughout pregnancy, but the number of subjects was so small.<sup>14,15</sup> It was reported that the value of PWV significantly decreased throughout pregnancy compared to that in the nonpregnant state.<sup>15</sup> However, neither the longitudinal changes in PWV throughout pregnancy in this large number of subjects nor the comparison of the value of PWV between normal pregnancy and PIH has been reported so far. These considerations led us to examine the baPWV value noninvasively during pregnancy and to evaluate the potential utility of this measuring PWV as a predictor of PIH. To our knowledge, this is the first longitudinal study of PWV during pregnancy in a large population.

## Material and methods

### Subjects

One hundred eighty-three pregnant women aged between 18 and 39 years were recruited from the patients visiting the obstetric outpatient clinic of Yamagata University Hospital and Yokoyama Hospital between October 2002 and December 2003. All procedures were

**Table I** Clinical characteristics of study subjects

|                          | Normal pregnancy group    | PIH group                 | <i>P</i> value |
|--------------------------|---------------------------|---------------------------|----------------|
| n                        | 167                       | 16                        |                |
| Age                      | 28.1 ± 4.3<br>(18-39)     | 30.2 ± 4.2<br>(21-39)     | .065           |
| Height (cm)              | 158.1 ± 5.2<br>(144-172)  | 158.2 ± 3.0<br>(152-163)  | .988           |
| Body weight (kg)         | 52.0 ± 7.2<br>(36-80)     | 58.7 ± 12.9<br>(45-85)    | < .01          |
| BMI (kg/m <sup>2</sup> ) | 20.8 ± 2.7<br>(14.6-33.7) | 23.4 ± 5.0<br>(18.7-34.0) | < .01          |

approved by the local ethics committee, and written informed consent was obtained from all patients. Clinical characteristics of this study population are summarized in Table I. We excluded subjects with chronic hypertension, hyperlipemia, diabetes mellitus, or bigeminal pregnancy. All subjects were nonsmokers. These 183 pregnant women were assessed for baPWV and other studied parameters longitudinally in the first trimester (gestational weeks 9-14, mean ± SD 10.50 ± 1.60 weeks), in the second trimester (gestational weeks 21-29, mean ± SD 25.03 ± 1.75 weeks), in the third trimester (gestational weeks 32-39, mean ± SD 33.94 ± 1.12 weeks), after their delivery (3-5 days after delivery, median 4 days), and at 1 month after their delivery. The gestational ages at delivery were 38.90 ± 1.28 weeks in normal group and 38.81 ± 1.42 weeks in PIH group.

We also studied blood pressure, body weight, urinary protein, urinary sugar, and edema. All newborns were studied with respect to their birth weight, Apgar score, and complications. PIH was diagnosed according to the definition of the American College of Obstetrics and Gynecology.<sup>16</sup> PIH was defined as hypertension or hypertension in addition to proteinuria after 20 weeks of gestation in previously normotensive women with no proteinuria. Hypertension was defined as a systolic blood pressure ≥ 140 mmHg or a diastolic blood pressure ≥ 90 mmHg. Proteinuria was defined as 2+ on urinalysis or proteinuria greater than 300 mg in a 24-hour collection. Five severe cases of PIH were observed.

### Methods

Brachial-to-ankle PWV was determined using an automatic device (the model BP-203PRE, Colin, Inc, Komaki, Japan), which allows pulse wave recording and automatic calculation of baPWV as previously described and validated.<sup>11,13</sup> This device records PWV, blood pressure, electrocardiogram, and heart sounds simultaneously. After 5 minutes' rest in the supine position, pressure wave forms of the brachial and tibial arteries were recorded with cuffs wrapped on both brachia and

Download English Version:

<https://daneshyari.com/en/article/3440604>

Download Persian Version:

<https://daneshyari.com/article/3440604>

[Daneshyari.com](https://daneshyari.com)