

COMMENTARY

Accumulation of evidence regarding home blood pressure during pregnancy is necessary

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According to the most recent Japanese guidelines for treating hypertension, home blood pressure should be given priority if clinical and home blood pressure values differ.¹ This is based on accumulated evidence regarding home blood pressure among non-pregnant subjects. The purpose of the reference value used should be taken into consideration; that is, for diagnosis or for treatment (target levels of blood pressure). Results from a cross-sectional study may be used to determine the reference value for diagnosis, but a prognosis-based study is more appropriate. In most international guidelines, 135/85 mm Hg of home blood pressure is now widely used as a criterion for the diagnosis of hypertension. The reference value was initially proposed based on the results of a cross-sectional study because there was no prognosis-based study. From cross-sectional analysis performed in the Ohasama study, the mean+1 s.d., mean +2 s.d. and the 95th percentile values obtained as reference upper limits for home blood pressure from subjects identified as normotensive based on screening blood pressure were 125/77, 137/86 and 134/83 mm Hg, respectively.² From longitudinal observation, the measured value for home blood pressure at which the relative risk of cardiovascular mortality is lowest is 120–127/72–76 mm Hg, but mortality increases significantly at 138/83 mm Hg.³ Nowadays, several cohort studies regarding home blood pressure exist. The results from the International Database of Home Blood Pressure in Relation to Cardiovascular

Outcome (IDHOCO), which integrated five cohort studies, suggest that 135/85 mm Hg should be adopted as a criterion for hypertension and that 125/80 mm Hg should be adopted as a criterion for normal blood pressure.⁴ Although we have to refer to the results of clinical trials to determine the target level for blood pressure treatment, there are no home blood pressure-based interventional studies, with the exception of the Hypertension Objective Treatment Based on Measurement by Electrical Devices of Blood Pressure (HOMED-BP) study.⁵ Therefore, evidence from cohort studies has been adopted.

There is little information on home blood pressure measurements in the 'Hypertension in women' section of the Japanese Society of Hypertension guidelines.¹ This is due to the existence of little evidence on home blood pressure among pregnant women. In the Japanese guidelines for the care and treatment of hypertension in pregnancy,⁶ 135/85 mm Hg is recommended as the reference value, adopted from the criterion for non-pregnant women.

Evidence on home blood pressure during pregnancy is currently being accumulated. We previously reported that home blood pressure was not different between primipara and multipara,⁷ and that the white coat effect in primipara was higher in early pregnancy than in multipara.⁸ Inoue *et al.*⁹ measured urinary salt excretion and home blood pressure for 7 consecutive days before the 20th and after the 30th gestational week. In the study, higher home blood pressure before the 20th gestational week and older age were significantly associated with the development of hypertensive disorders in pregnancy after adjustment for a family history of hypertension and serum uric acid in the first trimester. The adjusted odds ratio was 1.15 for home

systolic blood pressure and 1.14 for home diastolic blood pressure.⁹ Recently, we reported that home blood pressure had a significantly higher association with birth weight than clinical blood pressure.¹⁰

A cross-sectional study reported by Mikami *et al.*¹¹ based on longitudinal observation clearly showed a correlation between clinical blood pressure and home blood pressure among pregnant women. On the basis of the standard major axis method, home blood pressure values equivalent to a clinical blood pressure of 140/90 mm Hg were 120.8/83.5 mm Hg, 126.0/85.2 mm Hg and 136/89.3 mm Hg in the first, second and third trimesters, respectively. The results suggest that diagnostic thresholds based on home blood pressure in pregnant women at or near term are comparable with those for non-pregnant women.

We have to consider the peculiarities of pregnant women that can affect blood pressure. Hemodynamics during pregnancy has been shown to change dynamically.¹² As reported in the above study, there were different associations between home and clinical blood pressure in early and in late pregnancy. If equivalent values are confirmed in a future prognosis-based study, we have to re-consider the thresholds of home blood pressure in early pregnancy. Among hypertensive women in the clinical setting, home blood pressure values of 130/80 mm Hg may have to be considered not as white coat hypertension with low risk, but as sustained hypertension with high risk. A different research question is raised by this study. What kind of factor leads this change in correlation during pregnancy between home and clinical blood pressure? If the factor is identified, it may be beneficial for the

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prevention of sustained hypertension during pregnancy.

There are some limitations in these studies regarding home blood pressure during pregnancy. First, each study has relatively small participation for the analysis of the incidence of hypertensive disorders in pregnancy. If preeclampsia and gestational hypertension are considered separately, much larger populations are needed. Second, these studies were conducted in a single hospital, therefore, selection bias cannot be ruled out and the external validity is limited. Specifically, the setting of each study is quite different. Two studies enrolled pregnant women with relatively higher risk for hypertensive disorders in pregnancy.^{9,11} The mean ages of pregnant women in the study reported by Mikami *et al.*¹¹ and Inoue *et al.*⁹ were 35.8 and 34.1 years old, and 14% and 8% of the participants had chronic hypertension, respectively. The mean age in the study reported by Iwama *et al.*¹⁰ was 31.7 years old and only 4% of participants had chronic hypertension.

Two steps are necessary for development of future studies. First, several independent studies based on different settings are necessary. A relatively small population may be sufficient to address a specific clinical question. Second, a large-scale database is needed to conduct a study that includes all possible scenarios due to clinical heterogeneity. We can consider the influence of various settings reported in several similar studies. Eventually, an integrated study including meta-analysis and pooled analysis will strengthen these individual results. Integrated analysis taking into consideration the heterogeneity of each study creates a universal result. We are now on the first step toward accumulating sufficient evidence regarding home blood pressure in pregnant women. In the near future, the diagnostic and therapeutic threshold value of home blood

pressure among pregnant women should be determined based on combined evidence from several studies including the current study.

CONFLICT OF INTEREST

Aside from the present commentary, HM is executing collaborative research with Omron Healthcare. The remaining authors declare no conflict of interest.

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