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COMMENT

Maternal preconception blood pressure and the association with preterm birth

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Preterm birth, defined as birth prior to 37 weeks of gestation, has a significant effect on neonatal morbidity and mortality. Therefore, the prevention of preterm birth is a critical goal in perinatal care. Since an estimated 13.4 million neonates (9.9% of all births) were born preterm in 2020 compared with 13.8 million (9.8% of all births) in 2010 globally, there has been no significant change in the preterm birth rate over the past 10 years [1]. The preterm birth rate in Japan is lower compared to the world average [1, 2]. However, despite tremendous efforts to treat and prevent preterm births, the rate in Japan has increased slightly from 4.1% in 1980 to 5.4% in 2000 and 5.7% in 2010 [3]. Obstetric precursors leading to preterm birth are iatrogenic preterm delivery for maternal or fetal indications, spontaneous preterm labor with intact membranes, and preterm premature rupture of membranes [4]. Approximately 30–35% of preterm births are indicated, hypertensive disorder of pregnancy (HDP) is a significant cause of iatrogenic preterm delivery [4]. Hypertension is one of the most common medical disorders; its incidence increases with age. Recently, the number of older women becoming pregnant has increased and prevalence of advanced maternal age has increased worldwide and in Japan [5]. With this increasing age at pregnancy, various maternal complications, such as hypertension, are also increasing, highlighting the growing importance of preconception care. The World Health Organization defines preconception care as "biomedical, behavioral, and social health interventions for women and couples before conception"; its purpose is to improve the health of the mother and child in both the short and long term [6].

The present study by Xiong et al. [7] is a large, population-based, retrospective cohort study of over 0.7 million pregnant women examining the association between maternal preconception blood pressure (BP) and preterm birth. The results of this study revealed a U-shaped dose-response relationship between preconception systolic BP (SBP) and preterm birth and a linear dose-response relationship between preconception diastolic BP (DBP) and preterm birth. Maternal BP decreases physiologically from early to mid-pregnancy. Women with chronic hypertension who have experienced preeclampsia appear to reach the nadir earlier than women who do not experience preeclampsia [8, 9]. Many guidelines define chronic hypertension as that diagnosed before pregnancy or before 20 weeks of gestation [10–12]; however, a physiological decrease in BP can obscure the diagnosis of chronic hypertension at <20 weeks of gestation. When information about BP elevation is available only during pregnancy, especially during the second half of pregnancy, the diagnosis of either gestational hypertension or chronic hypertension can often only be made retrospectively. In this study by Xing et al., BP measurements taken 3.1 months (interquartile ranges, IQR: 1.7–5.2) before pregnancy were used, not BP measurements taken in early pregnancy. This approach allows for a more precise representation of the relationship between preconception BP and preterm birth.

Furthermore, a noteworthy aspect of this study is that the participants were examined by categorizing them into four groups as follows: normal BP (SBP < 120 mmHg and DBP < 80 mmHg), elevated BP (SBP 120–129 mmHg and DBP < 80 mmHg); stage 1 hypertension (SBP 130–139 mmHg and/or DBP 80–89 mmHg), and stage 2 hypertension (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg) according to the 2017 American College of Cardiology (ACC)/ American Heart Association (AHA) guidelines

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[13]. Their analysis showed that, not only women with stage 2 hypertension, but also those with elevated BP and stage 1 hypertension, had a significantly higher rate of preterm birth than women with normal BP before pregnancy. These results are consistent with studies indicating that stage 1 hypertension in early pregnancy is associated with a higher risk of HDP and preterm birth [14, 15].

Currently, the definition of hypertension differs slightly according to each guideline (Table 1). In 2017, the ACC and the AHA changed the diagnostic criteria for hypertension to ≥130/80 mmHg based on evidence that cardiovascular disease risk increases linearly with rising BP even below a threshold of 140/90 mmHg [13]. While the diagnostic threshold for hypertension remains at ≥140/90 mmHg in the 2019 Japanese Society of Hypertension (JSH) [16] and the 2020 International Society of Hypertension (ISH) [17] guidelines, the JSH defines SBP 120–129 mmHg and DBP < 80 mmHg as "high normal" BP, SBP 130–139 mmHg and DBP 80–89 mmHg as "elevated" BP, and the ISH defines SBP 130–139 mmHg and DBP 85–89 mmHg as "high normal" BP. Both guidelines recommend controlling BP < 130/80 mmHg in women of childbearing age. However, at this time, the American College of Obstetrics and Gynecologists (ACOG) [10], the Japan Society for the Study of Hypertension in Pregnancy (JSSHP) [11], and the International Society for the Study of Hypertension in Pregnancy (ISSHP) [12] continue to support a diagnosis of HDP, including chronic hypertension, when the BP is confirmed to be ≥140/90 mmHg. A recent study showed that using the lower diagnostic threshold for hypertension recommended by the ACC/AHA guidelines increased the prevalence of chronic and gestational hypertension, markedly improved the appropriate identification of women who would develop preeclampsia, and was associated with the identification of adverse fetal/neonatal risks [18]. While there is evidence supporting the benefits of treating mild chronic hypertension during pregnancy [19, 20] and an association between stage 1 hypertension, as defined by ACC/AHA, and adverse perinatal outcomes [14, 15], there are no data to suggest that treating non-severe hypertension at lower BP thresholds will improve maternal or perinatal outcomes.

In summary, this study indicated that abnormal maternal preconception BP, including elevated BP and stage 1 hypertension as defined by the ACC/AHA, is associated with an increased risk of preterm birth. This finding suggests that identifying and treating women with abnormal BP before pregnancy may improve perinatal outcomes. The preconception period is a crucial time for the detection and prevention of HDP, with fewer intervention limitations than during pregnancy. With an increase in high-risk pregnancies, such as those with advanced maternal age, the number of pregnant women at elevated risk who do not currently meet the diagnostic criteria for HDP, such as elevated BP and stage 1 hypertension as defined by the ACC/AHA, is expected to increase. This study had several limitations. There was no information on the presence or absence of treatment for hypertension, the presence or absence of HDP during pregnancy, and the cause of preterm birth was iatrogenic induced or spontaneous. Further research is

Table 1 BP categories in United states, Japanese, and International guidelines

<table>
<tr><th>BP category (mmHg)</th><th>AHA/ACC 2017</th><th>JSH 2019</th><th>ISH 2020</th><th>ACOG 2019</th><th>ISSHP 2018</th><th>JSSHP 2018</th></tr>
<tr><td>SBP <120 and DBP <80</td><td>Normal</td><td>Normal</td><td rowspan="2">Normal (DBP <85)</td><td colspan="3" rowspan="3">Normal</td></tr>
<tr><td>SBP: 120–129 and DBP <80</td><td>Elevated</td><td>High normal</td></tr>
<tr><td>SBP: 130–139 and/or DBP: 80-89</td><td>Stage1 hypertension</td><td>Elevated</td><td>High normal (DBP: 85–89)</td></tr>
<tr><td>SBP: 140-159 and/or DBP: 90-99</td><td rowspan="2">Stage2 hypertension</td><td>Grade1 hypertension</td><td>Grade1 hypertension</td><td colspan="3">Hypertension</td></tr>
<tr><td>SBP: 160-179 and/or DBP: 100-109</td><td>Grade2 hypertension</td><td>Grade2 hypertension</td><td colspan="3" rowspan="2">Severe hypertension (SBP ≥160 and/or DBP ≥110)</td></tr>
<tr><td>SBP ≥180 and/or DBP ≥110</td><td>Hypertension crisis (DBP ≥120)</td><td>Grade3 hypertension</td><td>Grade3 hypertension</td></tr>
</table>

ACOG American College of Obstetrics and Gynecologists, *AHA/ACC* American Heart Association/ American College of Cardiology, *BP* blood pressure, *DBP* diastolic BP, *ISH* International Society of Hypertension, *ISSHP* International Society for the Study of Hypertension in Pregnancy, *JSH* Japanese Society of Hypertension, *JSSHP* Japan Society for the Study of Hypertension in Pregnancy, *SBP* systolic BP

needed to assess whether interventions for women with elevated BP or stage 1 hypertension during the preconception period can improve perinatal outcomes, including a reduction in preterm births. Based on the research findings, there may be a need to reconsider the diagnostic criteria, management, and treatment strategies for HDP.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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