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## Echocardiographic Changes in Hypertensive Disorders of Pregnancy:

### Just Another Finding or a Clinical Outcomes Biomarker?

Anita Saraf, MD, PhD<sup>a,b,c,d</sup>

<sup>a</sup>Department of Medicine and Pediatrics, Adult Congenital Heart Disease Program, Heart and Vascular Institute, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA;

<sup>b</sup>John G. Rangos Sr. Research Center, University of Pittsburgh, Pittsburgh, Pennsylvania, USA;

<sup>c</sup>McGowan Institute for Regenerative Medicine, Pittsburgh, Pennsylvania, USA;

<sup>d</sup>Ageing Institute of Pittsburgh, Bridgeside Point 1, Pittsburgh, Pennsylvania, USA.

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Hypertension (HTN) is attributed to 1 in 5 deaths in women and is a risk factor for other cardiovascular diseases and outcomes. Per a recent state-of-the-art review, the diagnosis, treatment, and control rates of HTN in women were 59%, 47%, and 23%, respectively,<sup>1</sup> underscoring a significant gap in care that, if addressed, can lead to a decrease in morbidity and mortality in women. Pregnancy, which induces physiologic stress through hemodynamic, metabolic, and hormonal changes can be the first presentation of HTN and be a harbinger of severe cardiovascular disease with both short- and long-term consequences. In fact, hypertensive disorders of pregnancy (HDP) are the second leading cause of global maternal mortality at 31.6%.<sup>2</sup>

As the health care community evolves in its understanding of HDP through ongoing research studies, current guidelines can be lagging in recommending best practices for managing HDP. Per recent guidelines, normal blood pressure is defined as <120/80 mm Hg, and recommendations are targeted to treat blood pressures >130/90 mm Hg.<sup>3</sup> Although blood pressures naturally fall during the first trimester due to a decrease in systemic vascular resistance, a diagnosis of HTN in pregnancy counterintuitively has a higher threshold for treatment of >160/105 mm Hg per American College of Obstetrics and Gynecology and >140/90 mm Hg by other international guidelines.<sup>4</sup> Consequently, there is increased hesitation to aggressively treat HTN in pregnancy due to concerns that lowering blood

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ADDRESS FOR CORRESPONDENCE: Dr Anita Saraf, University of Pittsburgh Medical Center, 200 Lothrop Street, B535PUH, Pittsburgh, Pennsylvania 15213, USA. [saraf@pitt.edu](mailto:saraf@pitt.edu).

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pressure may compromise placental and fetal circulation, thereby restricting fetal growth and exposing the fetus to other harmful side effects. Furthermore, since most severe presentations of HTN including pre-eclampsia and eclampsia occur near term (37 weeks of gestation), the short duration of its incidence, often reversible by delivery of the baby, is not thought of as a long-term health care concern for the mother.

Therefore, systematic studies such as the Chronic Hypertension and Pregnancy trial<sup>5</sup> are important in reassuring women and their health care providers that targeting a blood pressure of <140/90 mm Hg is associated with better pregnancy outcomes rather than reserving treatment only for severe HTN without increasing fetal complications.

While we continue to discover reassuring data related to the safety of treating HTN for both the mother and her baby, it is just as important to evaluate the detrimental consequences of not adequately diagnosing and treating HDP.

HDP is associated with an increased risk of heart failure, diabetes, and chronic kidney disease, in addition to determinantal vascular outcomes including stroke. Women with pre-eclampsia have a 2-fold increased risk of ischemic heart disease with increased mortality and a 4-fold increased risk of developing chronic HTN.<sup>6</sup> There is increased evidence, including with the current study, that HTN in pregnancy is not just a clinical finding but also leads to pathological changes in the left ventricle (LV) myocardium.

Changes in the LV myocardium are normal during pregnancy. Some of these changes include a 5% to 10% increase in left ventricular mass and a 25% to 30% increase in wall thickness above prepregnancy levels, all within normal parameters.<sup>7,8</sup> Additionally, in approximately 40% of pregnancies, a small pericardial effusion without hemodynamic consequences is also detected.<sup>8</sup> These changes resolve postpartum in the majority of women, between 6 months and 2 years. In women with HDP, numerous studies have indicated adverse remodeling of the left ventricle associated with a pathological increase in myocardial thickness and increased diastolic dysfunction.<sup>9</sup>

In this issue of *JACC: Advances* the study by Alhuneafat et al<sup>10</sup> evaluated 427 women with HDP through a single center and compared their echo-cardiographic changes during or within 1 year of pregnancy to those of 279 pregnant women without HDP. The authors further categorized women with HDP into 3 categories: women with chronic HTN, pre-eclampsia (PRE), and chronic HTN with preeclampsia (SPE). The authors found that women with HDP have a higher degree of LV remodeling with LV diastolic filling abnormalities as well as incidence of pericardial effusions as compared to women without HDP. SPE women had the most significant changes as compared to the women with chronic HTN and PRE groups. Furthermore, differences in LV remodeling and LV diastolic function was present postdelivery, consistent with other studies that also demonstrated similar findings.<sup>11</sup> In fact, studies have demonstrated that women with HDP have pronounced abnormalities in LV structure and function numerous years after pregnancy.<sup>12</sup> These abnormalities are further exacerbated in women who have concurrent HTN with a history of HDP.

Overall, in this study, while 69% of women without HTN had normal LV parameters, only 40.5% of women with PRE and 26.7% of women with SPE had no abnormalities in any echocardiographic parameters measured. While these significant differences between normotensive women and women with HDP demonstrated now by numerous studies suggest that routine echocardiographic evaluation of women with HDP should be incorporated into our medical practice, the connection between abnormal diagnostic parameters and cardiovascular clinical outcomes in women is not yet established. While there is significant evidence to support the idea that women with HDP should be followed longitudinally and aggressively treated with antihypertensive medications, the value of echocardiography in guiding long-term management is still unclear. Furthermore, most studies, including the current study by Alhuneafat et al,<sup>10</sup> have looked at imaging parameters at a single time point alone and hence fall short in addressing whether these changes are reversible and if the reversibility of remodeling has implications on cardiovascular outcomes.

While there needs to be continued effort to increase awareness among women with HDP about their short- and long-term outcomes, from the perspective of the health care provider, the limitations arise from losing women with pregnancy complications to follow-up. In the United States, 40% of births are supported by the Medicaid program, where the mother's insurance coverage is terminated after 60 days of delivery. While this has improved over the last 2 years, where over 37 states now extend this coverage to 1 year after delivery, the extended coverage may be inadequate for over two-thirds of women with HDP who continue to remain hypertensive at 6 months after delivery with ongoing HTN detected up to 3 years postnatally.<sup>13</sup> Hence, similar studies would be most beneficial if diagnostic parameters could be used as biomarkers to risk-stratify women with HDP to advocate for extended health care coverage in high-risk women (Figure 1).

The importance of increasing awareness about the long- and short-term outcomes associated with pregnancy-related disorders is pertinent as we grapple with changing perspectives to the role women play in their pregnancies in the United States. Identifying parameters that reflect an increased burden of disease and increased risk for adverse cardiovascular outcomes and providing timely treatment is important to address the high mortality associated with HDP in developed countries like the United States.

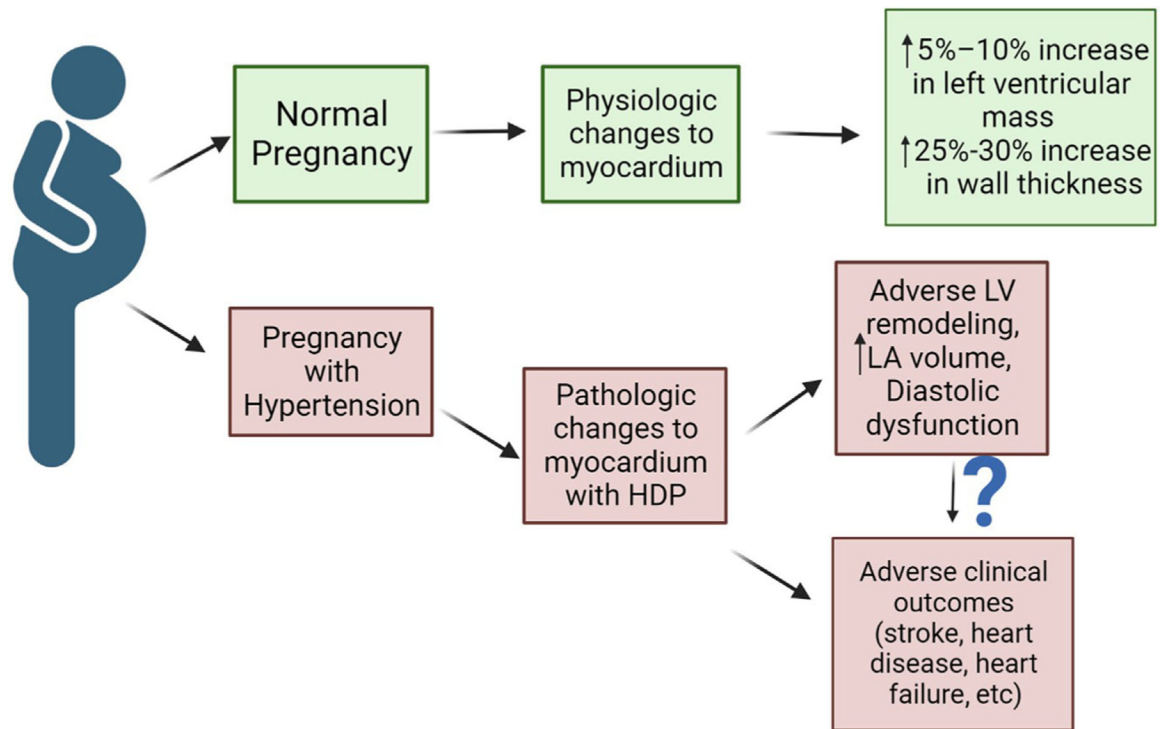
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**FIGURE 1.**

Schematic for Physiologic Versus Pathologic LV Remodeling With Hypertension in Pregnancy

HDP = hypertensive disorders of pregnancy; LA = left atrial; LV = left ventricular.