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ORIGINAL INVESTIGATIONS

Acute Cardiac Effects of Severe Pre-Eclampsia

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CME/MOC Objective for This Article: Upon completion of this activity, the learner should be able to: 1) identify echocardiographic changes associated with pre-eclampsia with severe features when compared to healthy pregnant controls; 2) discuss abnormal right ventricular strain analysis associated with pre-eclampsia; and 3) identify clinical implications, i.e., pulmonary edema, associated with echocardiographic changes in pre-eclampsia with severe features.

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ABSTRACT

BACKGROUND Pre-eclampsia with severe features (PEC) is a pregnancy-specific syndrome characterized by severe hypertension and end-organ dysfunction, and is associated with short-term adverse cardiovascular events, including heart failure, pulmonary edema, and stroke.

OBJECTIVES The authors aimed to characterize the short-term echocardiographic, clinical, and laboratory changes in women with PEC, focusing on right ventricular (RV) systolic pressure (RVSP) and echocardiographic-derived diastolic, systolic, and speckle tracking parameters.

METHODS In this prospective observational study, the authors recruited 63 women with PEC and 36 pregnant control patients.

RESULTS The PEC cohort had higher RVSP (31.0 ± 7.9 mm Hg vs. 22.5 ± 6.1 mm Hg; $p < 0.001$) and decreased global RV longitudinal systolic strain (RVLSS) (−19.6 ± 3.2% vs. −23.8 ± 2.9% [$p < 0.0001$]) when compared with the control cohort. For left-sided cardiac parameters, there were differences ($p < 0.001$) in mitral septal e′ velocity (9.6 ± 2.4 cm/s vs. 11.6 ± 1.9 cm/s), septal E/e′ ratio (10.8 ± 2.8 vs. 7.4 ± 1.6), left atrial area size (20.1 ± 3.8 cm^2 vs. 17.3 ± 2.9 cm^2), and posterior and septal wall thickness (median [interquartile range]: 1.0 cm [0.9 to 1.1 cm] vs. 0.8 cm [0.7 to 0.9 cm], and 1.0 cm [0.8 to 1.2 cm] vs. 0.8 cm [0.7 to 0.9 cm]). Eight women (12.7%) with PEC had grade II diastolic dysfunction, and 6 women (9.5%) had peripartum pulmonary edema.

CONCLUSIONS Women with PEC have higher RVSP, higher rates of abnormal diastolic function, decreased global RVLSS, increased left-sided chamber remodeling, and higher rates of peripartum pulmonary edema, when compared with healthy pregnant women. (J Am Coll Cardiol 2018;72:1–11) © 2018 by the American College of Cardiology Foundation.

Pre-eclampsia is a clinical syndrome characterized by hypertension with proteinuria and/or end-organ damage. Although the inciting pathology is not definitively known, pre-eclampsia occurs in 2% to 8% of pregnancies and is associated with early abnormal placentation, endothelial dysfunction, and systemic inflammation in the second half of pregnancy (1–5). Pre-eclampsia can lead to subsequent pulmonary edema (6,7), strokes (8), acute respiratory distress syndrome, placental abruption, HELLP (hemolysis, elevated liver enzymes, and low platelets) syndrome, disseminated intravascular coagulation, acute renal failure, liver rupture, seizures, or death (2,7,9). Maternal perinatal outcomes are more likely to be poor if pre-eclampsia occurs before the 32nd gestational week or is associated with pre-existing comorbidities (2). In particular, black women have higher rates of short- and long-term morbidity and mortality (2,10,11).

Pre-eclampsia is associated with deleterious changes in cardiovascular physiology, including increased systemic vascular resistance (12,13), capillary leak-induced interstitial edema (14), and pulmonary edema (4,15,16). Some studies have reported left ventricular (LV) systolic dysfunction, whereas others have found no changes (4,12,15,17,18). Right ventricular (RV) systolic function has also been reported to decline, although RV ejection fractions (EFs) remain within the normal range (19). By contrast, studies consistently report LV diastolic dysfunction, which can persist well into the postpartum state (20). Diastolic dysfunction likely results from abnormal LV remodeling and hypertrophy (4,17,18,21), with similar processes occurring in the RV (19,21).