Relation of the Number of Parity to Left Ventricular Diastolic Function in Pregnancy

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Left ventricular diastolic dysfunction (LVDD) has been relatively less studied than other cardiac changes during pregnancy. Previous studies revealed a mild diastolic deterioration during pregnancy. However, these studies did not evaluate the long-term effect of parity on left ventricular diastolic function. A comprehensive study evaluating the long-term effect of parity on diastolic function is required. A total of 710 women with various number of parity were evaluated through echocardiography to reveal the status of diastolic function. Echocardiographic parameters were compared among the women by parity number and categorized accordingly: none, 0 to 4 and 4< parity (grand multiparous). In nulliparous group, 19 women (23.2%) had grade 1 LVDD, and only 2 women (2.4%) had grade 2 LVDD. In women with a parity number of 0 to 4, 209 women (38.3%) had grade 1 LVDD, and only 17 women (3.1%) had grade 2 LVDD. In grand multiparous group, only 2 women (2.4%) did not have LVDD, and 12 women (14.6%) had grade 2 LVDD. None of the subjects had grade 3 or grade 4 LVDD. According to hierarchical logistic regression analysis, any grade of LVDD and grade 2 LVDD had the highest rates at parity category of > 4 parity and that had 21 and 5.8 times higher than nulliparous group, respectively. In conclusion, according to the present study, grand multiparity but not multiparity, severely deteriorates left ventricular diastolic function. Further studies are warranted to evaluate the risk of gradual diastolic dysfunction after each pregnancy. **(Am J Cardiol 2017;120:154−159)**

Pregnancy is a dynamic process and associated with substantial hemodynamic alterations that significantly affect circulatory system. Maternal hemodynamic changes begin in the first trimester of pregnancy and are characterized with an increase in circulating blood pool, heart rate, and stroke volume with a concurrent reduction in systemic vascular resistance.[1] With the physiological changes in cardiovascular system in pregnancy, compensatory changes in diastolic function occur as well. Left ventricular (LV) diastolic function has been relatively less studied than other cardiac changes during pregnancy. Previous studies evaluating the effect of pregnancy on diastolic function revealed a mild LV diastolic deterioration during the pregnancy.[2−5] In these studies, measurements were performed during only pregnancy. Therefore, a thorough study evaluating the long-term effect of the pregnancy on LV diastolic function is required to assess maternal health after the pregnancy. Therefore, we hypothesized that LV diastolic function would deteriorate progressively due to diastolic impairment with each pregnancy.[2−5] To test this hypothesis, we used echocardiography to investigate LVDD in nulliparous, primiparous, multiparous, and grand multiparous women.

Methods

This prospective study was performed in a tertiary heart center and included 710 consecutive women aged 35 to 65 years (mean, 43.3 ± 6.6 years). We included the women aged more than 35 years to create more homogeneous groups. The minimum time of pregnancy-free interval was 12 months. The duration of study was 14 months, from March 2015 to April 2016. The patients had no structural heart disease, history of preeclampsia and eclampsia, atrial fibrillation, using of medical treatment with chemotherapy, evidence of any concomitant inflammatory disorder, using glucocorticoid therapy within the past 3 months, secondary hypertension (HT) and any systemic disorder with the exception of obesity, HT, and diabetes that could significantly increase after load and induce LVDD were included in the present study. Ethical clearance was obtained from the ethics and research committee of our hospital. All participants gave written informed consent before enrollment in the study. The research was conducted in accordance with the principles of the Declaration of Helsinki.

HT was defined as systolic pressure greater than 140 mm Hg or diastolic pressure greater than 90 mm Hg. Diabetes

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See page 158 for disclosure information.

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Table 1
Baseline characteristics stratified by parity category

Parameters	Parity category			P value
	None (n=82) (n=82)	0 < to 4 (n=546) (n=554)	4 < (n=82) (n=84)	
Baseline characteristics				
Age (years)	41.6 ± 9.7*,†	43.9 ± 7.3‡	44.2 ± 3.9‡	0.027
Parity number (n)	0 ± 0*,†	2.4 ± 0.9†,‡	5.9 ± 1.2*,‡	<0.001
Time from last birth (years)	-	17.2 ± 9.5	18.7 ± 8.1	0.068
Dyspnea	6 (7.3)	39 (7.1)	20 (24.4)	<0.001
Hypertension	17 (20.7)	130 (23.8)	25 (30.5)	0.360
Hyperlipidemia	6 (7.3)	66 (12.1)	8 (9.8)	0.400
Pre-diabetes mellitus	5 (6.1)	34 (6.2)	8 (9.8)	0.978
Diabetes mellitus	14 (17.1)	72 (13.2)	16 (19.5)	0.238
Insulin use	7 (8.5)	34 (6.2)	9 (11.0)	0.250
Smokers	13 (15.9)	112 (20.5)	17 (20.7)	0.607
Body mass index (kg/m^2)	24.7 ± 5.2*,†	28.8 ± 6.0†,‡	31.8 ± 4.4*,‡	<0.001
Body surface area (m^2)	1.7 ± 0.1*,†	1.8 ± 0.1*,‡	1.9 ± 0.1†,‡	<0.001
Echocardiographic parameters				
Left ventricular end-systolic dimension (mm)	2.6 ± 0.3*,†	2.8 ± 0.4‡	2.9 ± 0.4‡	<0.001
Left ventricular end-diastolic dimension (mm)	4.3 ± 0.3*,†	4.5 ± 0.3†,‡	4.6 ± 0.3*,‡	0.003
Interventricular septum thickness (cm)	1.00 ± 0.19*,†	1.08 ± 0.20‡	1.11 ± 0.14‡	0.007
Posterior wall thickness (cm)	1.03 ± 0.25	1.06 ± 0.21	1.05 ± 0.13	0.315
Left ventricular ejection fraction	63.0 ± 3.0	62.5 ± 2.8	63.1 ± 2.6	0.418
Left ventricular mass index (g/m^2)	104.3 ± 35.5	112.1 ± 33.7	116.7 ± 22.8	0.103
Left atrial volume (mL)	39.1 ± 14.9†	39.3 ± 16.5†	51.8 ± 22.8*,‡	<0.001
Left atrial volume index (mL/m^2)	23.0 ± 8.6†	21.8 ± 8.6†	27.1 ± 11.7*,‡	<0.001
E (cm/s)	85.9 ± 21.4*,†	80.4 ± 18.1†,‡	69.8 ± 20.4*,‡	<0.001
A (cm/s)	73.1 ± 18.5	74.2 ± 17.2	77.5 ± 16.1	0.204
Deceleration time (ms)	152.3 ± 33.2*,†	167.1 ± 43.6‡	170.5 ± 40.6‡	0.005
e' lateral (cm/s)	14.1 ± 4.0*,†	12.8 ± 4.1†,‡	10.1 ± 2.1*,‡	<0.001
a' lateral (cm/s)	10.6 ± 2.6*,†	11.5 ± 2.6†,‡	11.8 ± 2.7*,‡	0.008
e' septal (cm/s)	11.3 ± 3.2*,†	9.9 ± 3.0†,‡	8.5 ± 2.3†,‡	<0.001
a' septal (cm/s)	9.7 ± 2.2	10.2 ± 2.0	10.5 ± 2.3	0.078
E/e'average ratio	7.0 ± 1.7†	7.3 ± 2.1†	7.8 ± 2.2*,‡	0.013
E/A ratio	1.2 ± 0.3*,†	1.1 ± 0.3†,‡	0.9 ± 0.2*,‡	<0.001
Propagation velocity (cm/s)	63.1 ± 10.7*,†	57.5 ± 10.1†,‡	44.9 ± 6.4*,‡	<0.001
Propagation velocity < 50	10 (12.2)*,†	130 (23.8)†,‡	66 (80.5)*,‡	<0.001
Pulmonary vein S/D ratio	1.07 ± 0.26*,†	1.03 ± 0.21†,‡	0.81 ± 0.15*,‡	<0.001
S/D ratio < 1	32 (39.0)	240 (44.0)	64 (78.0)	<0.001
Grade of left ventricular diastolic dysfunction				
0	61 (74.4)	321 (58.6)	2 (2.4)	
1	19 (23.2)	209 (38.3)	67 (81.7)	
2	2 (2.4)	17 (3.1)	12 (14.6)	

Continuous variables are presented as mean ± SD; nominal variables presented as frequency (%).
* p <0.005, 0 < parity ≤ 4 (post hoc test).
† p <0.005, 4< parity (post hoc test).
‡ p <0.005, nullipar (post hoc test).

mellitus (DM) was defined as the use of insulin or antidiabetic agents in the patient's medical history or a fasting glucose level greater than 126 mg/dl. Hyperlipidemia was defined as serum total cholesterol ≥ 240 mg/dl, serum triglyceride ≥ 200 mg/dl, low-density lipoprotein cholesterol ≥ 130 mg/dl, and previously diagnosed hyperlipidemia. Echocardiogram was performed using a Vivid 7 system (GE Vingmed Ultrasound AS, Horten, Norway). The parameters assessed were E (peak early filling velocity during atrial systole), A (peak filling velocity during atrial systole) ratio across mitral valve, S (systolic venous pulmonary venous flow), D (systolic venous pulmonary venous flow), propagation velocity of mitral valve flow, deceleration time in milliseconds, transmitral annular velocities on tissue Doppler (septal e', septal a', lateral e', and lateral a') in cm/s, left atrial (LA) volume index in ml/m^2, and LV ejection fraction. Grading of diastolic function was done as per the American Society of Echocardiography guidelines.[6]

Analyses were performed using Statistical Package for Social Sciences software, version 20.0 (SPSS; IBM, Armonk, New York). Baseline characteristics and echocardiographic parameters were compared among the patients by parity number and categorized accordingly: none, 0 to 4 and 4< parity (grand multiparity). Because according to previous studies, grand multiparity is commonly considered to give more than 4 births.[7,8] Continuous