Myocardial Function in Newborns of Well-Controlled Diabetic Mothers

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INTRODUCTION:

Gestational diabetes (GDM) is the most common metabolic complication of pregnancy. It's effect on the neonatal heart is well-recognized. Changes in morphology and function have been described both in utero and after birth, such as thicker intraventricular septum and decreased diastolic function (1). These changes have been related to fetal hyperinsulinemia and elevated insulin-like growth factor-I (IGF-1) which promote hypertrophy in cardiomyocytes, leading to decreased myocardial compliance and functional impairment.

Both cord insulin and c-peptide levels were previously found to be correlated with hypoglycemia in infants of diabetic mothers. In addition, C-peptide was lower and IGF-1 was higher in cord blood of infants to diabetic mothers with tight glycemic control versus less controlled diabetic mothers. (2,3)

OBJECTIVE:

Our study aimed to assess the link between myocardial changes and cord blood biomarkers of glycemic control.

METHODS:

This was a prospective observational study.

We recruited healthy term infants to mothers with and without GDM. Diagnosis of gestational diabetes was based on abnormal values in both glucose challenge test (GCT) and oral glucose tolerance test (OGTT).

We did not include mothers with pre-gestational diabetes, mothers with no screening tests and infants with IUGR or congenital anomalies.

Cord blood biomarkers (insulin, c-peptide, cortisol, IGF-1, HgA1C) were drawn and echocardiography was performed in all infants. Blood glucose testing was performed only in infants to diabetic mothers according to our local protocol.

Echocardiography was done prior to discharge by a single neonatologist using vivid S70N ultrasound system (GE Healthcare), under close supervision of a pediatric cardiologist. Study measurements were done offline.

RESULTS

- 35 infants were recruited. We excluded 4 : 1 infant who had an incidental finding of a mitral valve anomaly (later corrected surgically), 2 infants with suboptimal echo views, and 1 with no cord biomarkers.
- There were 16 infants in the gestational diabetes group (2 insulin controlled, one oral medication, and the rest diet-controlled), and 15 infants in the control group.
- Echocardiograms ranged between 17-73 hours of life.
- No significant differences were found between the groups in maternal and neonatal characteristics and in cord blood levels of biomarkers, and no hypoglycemic episodes were recorded in the gestational diabetes group, probably reflecting a well-controlled diabetic population
- No significant differences were found in all the echocardiographic measurements including LV and RV function, and indicators of pulmonary vascular resistance.

Maternal and neonatal characteristics		
	GDM group (n=16)	**Control group (n=15)**
Maternal age, y	30.7 ± 6.6	30.4 ± 4.29
Pregnancy number	2.4 ±1.5	2.0±1.6
Birth weight, g	3227 ±463	3450 ±388
Female (%)	50 (8/16)	73 (11/15)
Apgar 1-min	8.3 ± 1.7	8.4 ± 1.2
Apgar 5-min	9.5 ± 0.8	9.6 ± 0.8
Cord pH	7.24 ± 0.88	7.18 ± 0.11
Early onset sepsis risk factors (%)	31 (5/16)	33 (5/15)
LGA (%)	6.2 (1/16)	6 (1/15)
Caesarian section (%)	25 (4/16)	46 (7/15)
Age at echocardiogram, hr	34.3±11.9	37.8±20.1

Data are presented as mean ± SD
LGA= large for gestational age

Cord blood biomarkers		
	GDM group (n=16)	**Control group (n=15)**
Insulin, µIU/ml	7.14±6.95	7.57±7.38
C-Peptide, ng/ml	1.00±0.58	0.94±0.56
IGF-1, ng/ml	47±25.6	50.0±18.4
Cortisol, µg/dl	9.54±8.8	5.2±2.6
HgA1C, %	3.25±0.11	3.32±3.1
Echocardiographic measurements		
	GDM group (n=16)	**Control group (n=15)**
TAPSE (cm)	0.85±0.13	0.94 ± 0.14
Heart rate (beats/min)	132±21	125±16
LV output (ml/kg/min)	172±55	152±90
E/A ratio	1.051±0.28	1.02±0.19
Ejection fraction (%)	55.2±7.2	53.8±9.5
Aortic diameter	0.7±0.1	0.7±0.1
Fractional shortening (%)	37.8±4.6	37.6±5.4
Septal wall thickness (mm)	3±0.4	3±0.5
LV free wall thickness	3±0.3	3±0.4
PAAT/RVET	0.36±0.06	0.33±0.07
LV eccentricity index	1.3±0.26	1.16±0.15

Data are presented in mean ± SD, IGF-1= Insulin-like growth factor – 1, HgA1C= hemoglobin A1C, TAPSE - Tricuspid annular plane systolic excursion, LV=left ventricle, PAAT=pulmonary artery acceleration time, RVET=right ventricular ejection time

LIMITATIONS

- Small sample size – study ongoing
- No maternal data to confirm good glycemic control (fasting/post prandial sugar)
- No advanced imaging – deformation imaging, tissue Doppler imaging

CONCLUSIONS

In well-controlled diabetic mothers, neonatal myocardial function was comparable to controls.

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