



Tei index in determination of fetal cardiac function in pregnant women with gestational diabetes mellitus

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ABSTRACT

Objective: To explore the application value of Tei index in determination of fetal cardiac function in pregnant women with gestational diabetes mellitus (GDM). **Methods:** A total of 60 gestational diabetes mellitus pregnant women with single birth were included in the study and served as GDM group, while 60 healthy pregnant women with single birth were served as the control group. The fetal echocardiography was performed. The cardiac structure, function, and other related indicators were detected and compared. **Results:** IVSs, LVWT, RVWT, LVEF, LVFS, and RVFS in GDM group were significantly greater than those in the control group ($P < 0.05$). E/A MV and E/A TV in GDM group were significantly lower than those in the control group ($P < 0.05$). The left and right ventricular Tei index in GDM group was significantly higher than that in the control group ($P < 0.05$). **Conclusions:** The fetal cardiac structure and function in GDM pregnant women can cause damage to a different degree. Tei index is an important indicator to evaluate the fetal cardiac function in GDM pregnant women, and can be applied in the early diagnosis and treatment; therefore, it deserved to be widely recommended in the clinic.

1. Introduction

The following two conditions are involved in pregnancy merged with diabetes mellitus (DM). One is that on the basis of DM, the pregnancy is merged, also called DM merged with pregnancy. The other is that after pregnancy, DM occurs, also called gestational diabetes mellitus (GDM). Among the diabetic pregnant women, more than 90% have GDM, and less than 10% have DM merged with pregnancy[1]. Hyperglycemia can affect the embryonic development, easily cause macrosomia, fetal growth restriction, abortion, premature delivery, and fetal malformation, and alter the fetal cardiac structure and function. The study is aimed to explore the application value of Tei index in determination of fetal cardiac function in GDM pregnant women.

2. Materials and methods

2.1. Study objects

A total of 60 pregnant women with GDM who were admitted in our hospital from January, 2014 to December, 2015 were included in the study, gestational week from 24 to 38 weeks, with an average of (32.8±4.1) weeks; aged from 22 to 38 years old, with an average age of (29.9±3.9) years old. Moreover, 60 normal pregnant women served as the control group. All the objects had single liver birth. Those whose fetus had congenital heart diseases, arrhythmia, valvular regurgitation, and malformation, or those who had primary hypertension, organic heart disease, and other chronic diseases were excluded from the study.

2.2. Methods

GE V-730 and Apollo 500 (Toshiba) color Doppler ultrasound

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apparatus was used for the fetal heart function detection, with a transducer frequency of 3-5 MHz. The detected data and images were automatically saved by the above software system. The fetal routine examination was performed and the various indicators were measured. The fetal cardiac echocardiography was performed, and the various indicators of heart were measured and calculated as the following: (1) the transverse apical four chamber view was measured and calculated. The standard measuring area was located in the left ventricular chordae tendineae level (below the mitral valve). M type echocardiography was used to measure LVWT, RVWT, IVSs, IVSd, LVDs, RVDs, LVDd, and RVDd. LVEF, LVFS, and RVFS were calculated. (2) E/A MV and E/A TV were measured, respectively. (3) The left and right ventricular Tei index was measured. The above indicators in three cardiac cycles were measured, and the average value was taken and compared.

2.3. Statistical analysis

SPSS 17.0 software was used for the statistical analysis. The measurement data were expressed as mean±SD, and the independent sample *t*-test was used. $P<0.05$ was regarded as statistically significant difference.

3. Results

3.1. Comparison of the fetal cardiac structure and function between the two groups

IVSs, LVWT, RVWT, LVEF, LVFS, and RVFS in GDM group were significantly greater than those in the control group ($P<0.05$). The comparison of IVSd, LVDs, LVDd, RVDs, and RVDd between the two groups was not statistically significant ($P>0.05$) (Table 1). E/A MV and E/A TV in GDM group were significantly less than those in the control group ($P<0.05$). The left and right ventricular Tei index in GDM group was significantly greater than that in the

control group ($P<0.05$) (Table 2).

4. Discussion

With the wide application of fetal cardiac echocardiography in the perinatal monitoring, the fetal cardiac function change has been another emphasis for the fetal cardiac echocardiography. GDM is a common complication during the gestational period, with a gradually increasing morbidity. GDM often occurs in the second and third trimester. Hyperglycemia in GDM patients can induce many complications, such as macrosomia, fetal growth restriction, abortion, premature delivery, and fetal malformation. Therefore, in the study, Tei index is detected to evaluate the fetal cardiac function in GDM pregnant women.

Some researches demonstrate that[2] the heart weight and ventricular wall thickness of the dead fetus in GDM pregnant women are greater than those in the normal pregnant women. The results in the study showed that IVSs, LVWT, and RVWT in GDM group were significantly higher than those in the control group ($P<0.05$), indicating that the maternal hyperglycemia can affect the fetal cardiac structure to cause myocardial hypertrophy. The results in the study showed that LVEF, LVFS, and RVFS in GDM group were significantly higher than those in the control group ($P<0.05$); E/A MV and E/A TV in GDM group were significantly lower than those in the control group ($P<0.05$), suggesting that the maternal hyperglycemia can affect the fetal cardiac systolic and diastolic function.

Tei index, also called cardiac function comprehensive index, firstly proposed by the Japanese scholar Chuwa Tei, is the ratio of ET and IRT+ICT, and is commonly applied to evaluate the cardiac systolic and diastolic function in the clinic[3]. The cardiac index and EF can evaluate the cardiac systolic function, the Doppler mitral valve filling indicators and isovolumic contraction period can evaluate the diastolic function, but due to their limitations, the heart rate, the cardiac cavity geometry, and the valvular regurgitation can

Table 1

Comparison of fetal cardiac structure between two groups.

Groups	IVSs (mm)	IVSd (mm)	LVWT (mm)	RVWT (mm)	LVDs (mm)	LVDd(mm)	RVDs (mm)	RVDd (mm)
GDM group	4.85±1.23	4.05±1.08	5.05±1.38	4.95±1.34	7.37±1.30	11.85±2.38	9.11±2.59	13.95±1.88
Control group	3.35±1.02	3.65±1.38	3.82±1.25	3.78±1.24	7.40±1.34	11.65±2.28	8.86±2.36	13.35±1.77
<i>P</i> value	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05	>0.05

Table 2

Comparison of fetal cardiac function between two groups.

Groups	LVEF (%)	LVFS (%)	RVFS (%)	E/A _{MV}	E/A _{TV}	LV MPI	RV MPI
GDM group	74.66±5.54	41.13±5.21	40.32±6.92	0.61±0.10	0.60±0.09	0.52±0.045	0.57±0.030
Control group	69.37±6.34	36.12±4.78	35.23±5.68	0.78±0.11	0.78±0.10	0.33±0.091	0.35±0.028
<i>P</i> value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

LV MPI: left ventricular Tei index; RV MPI: right ventricular Tei index.

be affected; therefore, their application in the clinic has a certain restriction[4-7]. Actually, when the cardiac function is incomplete, the abnormal systolic and diastolic function often coexists; therefore, the comprehensive evaluation of the cardiac integrity is more appropriate[8-10]. Tei index is the overall function index. In recent years, some researches demonstrate that Tei index is a simple, sensitive, reliable, and important indicator to evaluate the coronary heart disease, cardiomyopathy, and fetal cardiac overall function[11-13]. Due to the preferable repeatability, simple operation, and small effect by the cardiac structure change and heart rate, the pulsed Doppler blood flow spectrum is used to measure Tei index which is ideal method to evaluate the fetal cardiac function in the clinic. The results in the study showed that the left and right ventricular Tei index in GDM group was significantly greater than that in the control group ($P < 0.05$), indicating that hyperglycemia in GDM pregnant women can damage the left and right ventricular function of the fetus.

In conclusion, Tei index can accurately evaluate the cardiac function of fetus in GDM pregnant women. If the fetal cardiac Tei index in GDM pregnant women is elevated, the blood sugar monitoring should be highly taken into account and the blood sugar level should be controlled timely in order to reduce the damage on the fetal myocardial function and improve the pregnancy outcome.

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