

doi: 10.13241/j.cnki.pmb.2017.12.035

超声心动图评价妊娠期糖尿病孕妇胎儿心脏结构及功能中的临床研究

石伟¹ 刘海霞² 罗一¹ 王永森³ 刘沙娟¹

(1 河北省沧州市中心医院医学统计科 河北 沧州 061000 ;

2 河北省沧州市中心医院超声三科 河北 沧州 061000;3 河北省沧州市中心医院体检中心 河北 沧州 061000)

摘要 目的:探讨超声心动图评价妊娠期糖尿病(GDM)孕妇胎儿心脏结构及功能的价值。**方法:**收集2014年1月至2016年12月我院住院分娩的156例GDM孕妇为GDM组,并于同期随机选取50例孕周匹配的健康妊娠孕妇为对照组,在妊娠末期采用超声心动图对两组胎儿进行检查,检查内容包括胎儿的心脏瓣环内径、心脏结构以及心脏功能。**结果:**GDM组孕妇胎儿的MVA、TVA、AVA、PVA均比对照组大,差异有统计学意义($P<0.05$)。GDM组孕妇胎儿的IVSs、IVSd、LVWtd、LVWts、RVWtd、RVWts均比对照组大,差异有统计学意义($P<0.05$)。GDM组孕妇胎儿的LVEF、LVFS、RVFS均比对照组大,E/AMV、E/ATV均比对照组小,差异有统计学意义($P<0.05$)。GDM组孕妇胎儿左室Tei指数(LV MPI)、右室Tei指数(RV MPI)均大于对照组($P<0.05$)。**结论:**GDM孕妇胎儿心脏结构和功能存在不同程度的改变,超声心动图能有效监测胎儿的心脏结构和功能,从而为临床早期干预和改善预后提供依据。

关键词:超声心动图;妊娠期糖尿病;心脏结构;心脏功能

中图分类号:R714.256 **文献标识码:**A **文章编号:**1673-6273(2017)12-2338-04

Clinical Study of Echocardiography in the Evaluation of Fetal Heart Structure and Function in Pregnant Women with Gestational Diabetes Mellitus

SHI Wei¹, LIU Hai-xia², LUO Yi¹, WANG Yong-sen³, LIU Sha-juan¹

(1 Department of Medical Statistics, Cangzhou Central Hospital of Hebei Province, Cangzhou, Hebei, 061000, China;

2 Third Department of Ultrasound, Cangzhou Central Hospital of Hebei Province, Cangzhou, Hebei, 061000, China;

3 Physical Examination Center, Cangzhou Central Hospital of Hebei Province, Cangzhou, Hebei, 061000, China)

ABSTRACT Objective: To study the value of echocardiography in the evaluation of fetal heart structure and function in pregnant women with gestational diabetes mellitus (GDM). **Methods:** 156 pregnant women with GDM in our hospital from January 2014 to December 2016 were selected as GDM group. In the same period, 50 healthy pregnant women with matched gestational age were randomly selected as control group. At the end of gestation, the fetuses of two groups were examined by the echocardiography, including fetal heart valve ring diameter, heart structure and heart function. **Results:** The MVA, TVA, AVA, PVA in fetals of the GDM group were higher than those of the control group, and the differences were statistically significant ($P<0.05$). The IVSs, IVSd, LVWtd, LVWts, RVWtd, RVWts in fetals of the GDM group were higher than those of the control group, the differences were statistically significant ($P<0.05$). The LVEF, LVFS, RVFS in fetals of the GDM group were higher than those of the control group, and the E/AMV, E/ATV were less than those of the control group, the differences were statistically significant ($P<0.05$). The left ventricular Tei index (LV MPI) and right ventricular Tei index (RV MPI) of fetals of the GDM group were larger than those of the control group ($P<0.05$). **Conclusion:** The fetal structure and function of pregnancy women with GDM have varying degrees of change, and echocardiography can effectively monitor the fetal heart structure and function, so that to provide early clinical intervention and improve prognosis.

Key words: Echocardiography; Gestational diabetes mellitus; Heart structure; Heart function

Chinese Library Classification(CLC): R714.256 **Document code:** A

Article ID: 1673-6273(2017)12-2338-04

前言

妊娠期糖尿病(gestational diabetes mellitus, GDM)是指妊娠前未确诊而在妊娠期间确诊或者是在妊娠期间发生的糖尿病,是妊娠期常见并发症,随着人们生活水平的提高,GDM的发病率呈逐渐上升趋势^[1,2]。妊娠期间高血糖可使胚胎发育障碍

甚至死亡,流产率约为15%~30%,活胎则易发生先天性畸形、胎儿生长受限等不良结局^[3,4]。有研究报道^[5],GDM孕妇的高血糖水平还可引起胎儿心脏结构发生改变,如心腔扩大、心室壁增厚、心肌肥厚等,造成心脏功能异常,如心室舒张/收缩功能受损等。多普勒超声心动图是临床常见的无创性检查手段,可有效评估胎儿的心脏结构及功能,从而为临床决策提供科学依据^[6]。本研究采用超声心动图评估GDM孕妇妊娠末期胎儿心脏结构及功能变化,旨在为临床早期制定干预措施改善新生儿预后提供指导,现报道如下:

作者简介:石伟(1980-),男,本科,主治医师,从事数据分析及评估方面的研究,E-mail: 85556496@qq.com

(收稿日期:2016-12-26 接受日期:2017-01-12)

1 资料与方法

1.1 一般资料

收集 2014 年 1 月至 2016 年 12 月我院住院分娩的 156 例 GDM 孕妇为 GDM 组,纳入标准:确诊为 GDM 的单胎妊娠患者,其中 GDM 诊断标准^[7]:妊娠 24~28 周时进行 75 g 葡萄糖耐量试验(OGTT),空腹、糖负荷后 1 h、负荷后 2 h 的血糖临界值分别为 5.1、10.0、8.5 mmol/L,其中任何一个时间点的血糖值达到或者超过临界值即可诊断为 GDM。排除标准:① 心脏功能异常者;② 肝、肾功能障碍者;③ 妊娠前合并有糖尿病或者高血压的患者;④ 超声结果显示胎儿畸形者;⑤ 血常规异常、凝血功能障碍者。GDM 孕妇年龄 24~38 岁,平均(29.2±5.1)岁;孕次 1~4 次,平均(2.7±0.3)次;产次 1~3 次,平均(1.4±0.5)次;孕周 34~39 周,平均(36.8±1.6)周。并于同期随机选取 50 例健康孕妇为对照组,年龄 22~36 岁,平均(28.5±5.3)岁;孕次 1~4 次,平均(2.5±0.4)次;产次 1~4 次,平均(1.2±0.5)次;孕周 35~38 周,平均(36.1±1.5)周。两组的年龄、孕次、产次、孕周比较,差异无统计学意义($P>0.05$),具有可比性。本研究所有研究对象均在知情同意书上签字,且该研究得到医院伦理委员会的批准。

1.2 方法

超声诊断仪探头频率为 3~5MHz (西门子 ACUSON S3000)。

1.2.1 测量胎儿心脏瓣环内径 在四腔心切面上测量二尖瓣环内径(mitral valve annulus,MVA)和三尖瓣环内径(tricuspid valve annulus,TVA),在主动脉长轴切面上测量主动脉瓣环内径(aortic valve annulus,AVA),在肺动脉长轴切面上测量肺动脉瓣环内径(pulmonary valve annulus,PVA)。

1.2.2 测量胎儿心脏结构 在横位四腔心切面上,测量左心室舒张末期内径(left ventricular dimension end-diastolic,LVDd)、右心室舒张末期内径(right ventricular dimension end-diastolic,RVDd)、左心室收缩末期内径(left ventricular dimension

end-systole,LVDs)、右心室收缩末期内径(right ventricular dimension end-systole,RVDs)、室间隔收缩末期厚度(interventricular septum end-systole,IVSs)、室间隔舒张末期厚度(interventricular septum end-diastolic,IVSd)、左室壁舒张末期厚度(left ventricular wall thickness end-diastolic,LVWTd)、左室壁收缩末期厚度(left ventricular wall thickness end-systolic,LVWTs)、右室壁舒张末期厚度(right ventricular wall thickness end-diastolic,RVWTd)、右室壁收缩末期厚度(right ventricular wall thickness end-systolic,RVWTs),同时计算左室短轴缩短率(left ventricular fraction systolic,LVFS)、左室射血分数(left ventricular ejection fraction,LVEF)、右室短轴缩短率(right ventricular fraction systolic,RVFS)。

1.2.3 测量胎儿心脏功能 在心尖或者心底四腔心切面上,脉冲多普勒取样框放置于二/三尖瓣跨瓣处,使血流与声束夹角 $<20^\circ$ 的同时显示二/三尖瓣血流频谱,此时测量二/三尖瓣 E、A 峰值速度的比值(E/AMV、E/ATV)。

1.2.4 心室 Tei 指数 左室 Tei 指数相关参数:a1 为二尖瓣口舒张期血流频谱终点与下一频谱起点的时间距离;b1,主动脉瓣口收缩期血流频谱持续的时间;左室 Tei 指数(LV MPI)=(ICT+IRT)/ET=(a1-b1)/b1,其中 ICT(isovolumic contraction)为等容收缩时间,IRT(isovolumic relaxation time)为等容舒张时间,ET(ejection time)为心室射血时间,右室 Tei 指数(RV MPI)与左室测量方法一致。连续测量 3 个心动周期取平均值。

1.3 统计学处理

本研究中所有数据均采用 SPSS16.0 软件录入并进行统计分析,定量资料用($\bar{x}\pm s$)表示,两独立资料比较采用成组 t 检验,差异有统计学意义时 $P<0.05$ 。

2 结果

2.1 两组孕妇胎儿心脏各瓣环内径比较

GDM 组孕妇胎儿的 MVA、TVA、AVA、PVA 均比对照组大,差异有统计学意义($P<0.05$)。见表 1。

表 1 比较两组孕妇胎儿心脏各瓣环内径

Table 1 Comparison of valve annulus diameter of fetal heart between two groups

Groups	n	MVA(mm)	TVA(mm)	AVA(mm)	PVA(mm)
GDM group	156	8.22±0.98 *	9.30±1.62 *	6.78±0.81 *	6.59±1.22 *
Control group	50	7.51±1.06	8.57±1.53	6.43±0.95	5.72±1.34
t	-	4.375	2.816	2.551	4.289
P	-	0.000	0.005	0.012	0.000

Note: Compared with the control group, * $P<0.05$.

2.2 两组孕妇胎儿心脏结构相关指标比较

GDM 组与对照组孕妇胎儿 LVDd、RVDd、LVDs、RVDs 比较,差异无统计学意义($P>0.05$),GDM 组孕妇胎儿 IVSs、IVSd、LVWTd、LVWTs、RVWTd、RVWTs 大于对照组,差异有统计学意义($P<0.05$)。见表 2。

2.3 两组孕妇胎儿心脏功能相关指标比较

GDM 组孕妇胎儿的 LVEF、LVFS、RVFS 均比对照组大,E/AMV、E/ATV 均比对照组小,差异有统计学意义($P<0.05$)。

见表 3。

2.4 两组孕妇胎儿心室 Tei 指数比较

GDM 组孕妇胎儿左室 a1-b1、右室 a2-b2、LV MPI 以及 RV MPI 均大于对照组,差异有统计学意义($P<0.05$)。见表 4。

3 讨论

GDM 是临床常见的孕产妇并发症,常发生于孕中期、孕晚期,调查显示,国外 GDM 的发生率为 1%~14%,我国 GDM 的

表 2 比较两组孕妇胎儿心脏结构相关指标 (mm)

Table 2 Comparisons of fetal heart structure indicators between two groups (mm)

Groups	n	LVDd	RVDd	LVDs	RVDs	IVSs	IVSd	LVWtd	LVWts	RVWtd	RVWts
GDM group	156	11.53±1.38	13.34±1.27	6.87±0.98	8.39±1.26	5.19±0.95 *	4.90±1.57 *	4.76±0.89 *	5.63±1.24 *	5.27±0.62 *	5.45±1.22 *
Control group	50	11.24±1.29	12.98±1.35	7.01±0.95	8.25±1.31	4.52±1.01	4.28±1.64	3.92±1.05	4.59±1.36	4.91±0.73	4.97±1.36
t	-	1.312	1.729	-0.895	0.587	4.278	2.403	5.556	5.049	3.426	2.358
P	-	0.191	0.087	0.377	0.499	0.000	0.017	0.000	0.000	0.001	0.019

Note: Compared with the control group, * P<0.05.

表 3 比较两组孕妇胎儿心脏功能相关指标

Table 3 Comparison of fetal heart function between two groups

Groups	n	LVEF (%)	LVFS (%)	RVFS (%)	E/AMV	E/ATV
GDM group	156	75.39±3.38 *	45.07±1.06 *	43.39±0.89 *	0.73±0.08 *	0.71±0.05 *
Control group	50	67.51±4.09	39.68±1.17	36.72±1.05	0.86±0.11	0.85±0.09
t	-	13.612	30.507	44.098	-9.835	-13.892
P	-	0.000	0.000	0.000	0.000	0.000

Note: Compared with the control group, * P<0.05.

表 4 比较两组孕妇胎儿左、右室 Tei 指数

Table 4 Comparisons of fetal left/right ventricular Tei index between groups

Groups	n	a1-b1 (ms)	b1 (ms)	LV MPI	a2-b2 (ms)	b2 (ms)	RV MPI
GDM group	156	75.68±8.59 *	176.34±12.20	0.45±0.08 *	79.11±10.24 *	175.28±13.36	0.49±0.13 *
Control group	50	65.42±9.61	173.59±11.87	0.39±0.06	72.26±9.35	178.93±12.24	0.41±0.12
t	-	7.149	1.402	-4.889	4.208	-1.716	3.861
P	-	0.000	0.164	0.000	0.000	0.088	0.001

Note: Compared with the control group, * P<0.05.

发生率约为 1%~5%,并有逐渐上升的趋势^[8]。GDM 孕妇高胰岛素血症以及高血糖水平可引起胎儿蛋白质和脂肪的储存,造成胎儿早产或者巨大儿等^[9,10]。Demirpençe^[11]研究发现,GDM 孕妇胎儿的心室壁厚度以及心脏重量明显大于健康妊娠孕妇胎儿,提示 GDM 可能造成心脏结构的改变,而心脏结构发生改变又会对胎儿的心脏功能造成一定影响。因此,监测 GDM 孕妇妊娠末期胎儿的心脏结构以及功能有利于围产期保健,是早期干预胎儿心脏异常及改善预后的重要措施。超声是临床常见的无创性辅助检查手段,具有操作方便的特点,能够及时掌握胎儿的生长发育情况,从而为早期干预胎儿畸形提供依据^[12,13]。

本研究采用超声心动图对 GDM 孕妇妊娠末期胎儿进行监测,结果显示,GDM 孕妇胎儿 MVA、TVA、AVA、PVA 均大于对照组,说明 GDM 孕妇的胎儿心脏各个瓣膜环内径明显增加,右心腔的内径增大,提示孕妇血糖水平升高可能使胎儿心脏发生改变而出现心肌肥厚,与有关研究结果一致^[14]。此外,结果表明 GDM 组孕妇胎儿 IVSs、IVSd、LVWtd、LVWts、RVWtd、RVWts 大于对照组,提示 GDM 孕妇胎儿的心脏结构存在不同程度异常,与有关研究结果一致^[15],即 GDM 孕妇胎儿的心脏结构因母体血糖水平过高,机体处于高代谢、高胰岛素状态,进而使胎儿在相对缺氧以及高氧耗状态下生长发育,

为满足胎儿生理状态下的生长发育需要,胎儿心脏结构变化如心腔内径变大等。GDM 孕妇机体呈高血糖水平使胎儿心脏结构发生改变,而心脏的结构变化有可能对心脏的功能产生影响,因此监测胎儿心脏功能具有重要意义。本研究结果中,GDM 孕妇胎儿的 LVEF、LVFS、RVFS 比对照组大,而 E/AMV、E/ATV 比对照组小,提示 GDM 孕妇的心肌发生肥厚,进而通过影响心脏的收缩功能以及降低顺应性而损伤心脏的舒张功能。同时本研结果也说明采用超声心动图可以有效评估 GDM 孕妇胎儿的心脏功能变化情况,从而为临床早期干预提供指导。Tei 指数主要用于评估患者的心脏收缩功能和舒张功能,是临床常见的不受心脏结构以及心率等因素影响的超声学指标,同时也不受血流方向夹角以及超声束等的影响^[16,17]。目前临床常将 Tei 指数用于临床评估新生儿的心脏功能,在将其用于妊娠晚期胎儿心脏功能的评估相对较少。有研究显示^[18],在妊娠晚期对心脏功能进行测量时,胎儿以及骨骼声影不会对 Tei 指数的测量产生干扰,容易测量成功,因此本研究将其用于评估胎儿的心脏功能。结果显示,GDM 组孕妇胎儿左室 ICT+IRT、右室 ICT+IRT 大于对照组,该结果进一步提示 GDM 孕妇胎儿心脏结构异常,(ICT+IRT)延长,这与母体的高水平血糖使胎儿心肌增厚,降低了心肌顺应性有关,并且 GDM 组

孕妇胎儿左右心室的 Tei 指数均大于对照组,提示 GDM 孕妇母体高血糖水平对胎儿左右心室的整体功能均造成不同程度的损伤,这与有关研究结果相似^[19,20],即 Tei 指数可早期评估心脏的功能,尤其是对心室功能异常的评估。

综上所述,GDM 孕妇的高血糖水平可能造成胎儿心脏结构的异常,并进一步影响心脏的整体功能,因此临床应早期干预孕妇的血糖水平,并重点监测胎儿的心脏功能,以早期发现异常并及时采取干预措施。超声心动图能有效监测胎儿的心脏结构以及功能,并早期发现胎儿心脏整体异常情况,从而为早期干预提供重要依据,同时具有无辐射、无创以及反复操作等特点,因此将其用于胎儿心脏结构及功能监测有重要的临床意义,值得推广。

参考文献(References)

- [1] Bhograj A, Suryanarayana KM, Nayak A, et al. Serum adiponectin levels in gestational diabetes mellitus [J]. Indian J Endocrinol Metab, 2016, 20(6): 752-755
- [2] Blackwell SC, Landon MB, Mele L, et al. Relationship Between Excessive Gestational Weight Gain and Neonatal Adiposity in Women With Mild Gestational Diabetes Mellitus[J]. Obstet Gynecol, 2016, 128(6): 1325-1332
- [3] 安娜,刘雯,赵丽娜,等.妊娠期糖尿病孕妇血糖水平与新生儿体质量的相关性[J].现代生物医学进展, 2015, 15(23): 4490-4491, 4508
An Na, Liu Wen, Zhao Li-na, et al. Relationship of Blood Glucose Levels of Pregnant Women with Gestational Diabetes and the Birth Weight of Newborns [J]. Progress in Modern Biomedicine, 2015, 15 (23): 4490-4491, 4508
- [4] Shahbazian H, Noughjah S, Shahbazian N, et al. Gestational diabetes mellitus in an Iranian pregnant population using IADPSG criteria: Incidence, contributing factors and outcomes [J]. Diabetes Metab Syndr, 2016, 10(4): 242-246
- [5] Appiah D, Schreiner PJ, Gunderson EP, et al. Association of Gestational Diabetes Mellitus With Left Ventricular Structure and Function: The CARDIA Study [J]. Diabetes Care, 2016, 39 (3): 400-407
- [6] Wang H, Xu Y, Fu J, et al. Evaluation of the regional ventricular systolic function by two-dimensional strain echocardiography in gestational diabetes mellitus (GDM) fetuses with good glycemic control[J]. J Matern Fetal Neonatal Med, 2015, 28(18): 2150-2154
- [7] International Association of Diabetes and Pregnancy Study Groups Consensus Panel, Metzger BE, Gabbe SG, et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy[J]. Diabetes Care, 2010, 33(3): 676-682
- [8] 宋成秋,赵亚田,王静,等.200 例妊娠期糖尿病临床分析[J].现代生物医学进展, 2014, 14(27): 5267-5269
Song Cheng-qiu, Zhao Ya-tian, Wang Jing, et al. Clinical Analysis of 200 Cases of Gestational Diabetes [J]. Progress in Modern Biomedicine, 2014, 14(27): 5267-5269
- [9] Gelber SE, McCullough LB, Chervenak FA. Ethical Dimensions of Counseling about the Clinical Management of Gestational Diabetes [J]. Am J Perinatol, 2016, 33(13): 1262-1265
- [10] Kayal A, Mohan V, Malanda B, et al. Women in India with Gestational Diabetes Mellitus Strategy (WINGS): Methodology and development of model of care for gestational diabetes mellitus (WINGS 4)[J]. Indian J Endocrinol Metab, 2016, 20(5): 707-715
- [11] Demirpençe S, Demirpençe BI, Meşe T, et al. Predictors of postnatal complications and congenital cardiac diseases in infants of mothers with pregestational and gestational diabetes [J]. Turk Pediatri Ars, 2014, 49(4): 299-306
- [12] Arslan D, Oran B, Vatansev H, et al. The usefulness of plasma asymmetric dimethylarginine (ADMA) levels and tissue dopplerechocardiography for heart function in term infants born to mothers with gestational diabetes mellitus[J]. J Matern Fetal Neonatal Med, 2013, 26(17): 1742-1748
- [13] Garg S, Sharma P, Sharma D, et al. Use of fetal echocardiography for characterization of fetal cardiac structure in women with normal pregnancies and gestational diabetes mellitus [J]. J Ultrasound Med, 2014, 33(8): 1365-1369
- [14] Wang H, Xu Y, Fu J, et al. Evaluation of the regional ventricular systolic function by two-dimensional strain echocardiography in gestational diabetes mellitus? (GDM) fetuses with good glycemic control[J]. J Matern Fetal Neonatal Med, 2015, 28(18): 2150-2154
- [15] Liu S, Rouleau J, Leon JA, et al. Impact of pre-pregnancy diabetes mellitus on congenital anomalies, Canada, 2002-2012 [J]. Health Promot Chronic Dis Prev Can, 2015, 35(5): 79-84
- [16] Morita T, Nakamura K, Osuga T, et al. Repeatability and reproducibility of right ventricular Tei index values derived from three echocardiographic methods for evaluation of cardiac function in dogs[J]. Am J Vet Res, 2016, 77(7): 715-720
- [17] Bokiniec R, W łasienko P, Borszewska-Kornacka MK, et al. Myocardial performance index (Tei index) in term and preterm neonates during the neonatal period [J]. Kardiol Pol, 2016, 74 (9): 1002-1009
- [18] Kilic A, Yarlioglues M, Ercan EA, et al. Association of total serum antioxidant capacity with the Tei index in echocardiography in patients with microvascular angina[J]. Coron Artery Dis, 2015, 26(7): 620-625
- [19] Luewan S, Tongprasert F, Srisupundit K, et al. Fetal myocardial performance (Tei) index in fetal hemoglobin Bart's disease [J]. Ultraschall Med, 2013, 34(4): 355-358
- [20] Lee MY, Won HS, Jeon EJ, et al. Feasibility of using auto Mod-MPI system, a novel technique for automated measurement of fetal modified myocardial performance index [J]. Ultrasound Obstet Gynecol, 2014, 43(6): 640-645