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Original article

The relation between interventricular septum thickness and fetal macrosomia in patients with gestational diabetes mellitus

Eman Zein Elabdeen Farid , Mohamed Abdelrahman Mohamed and Amr Mohamed Nazmy

Obstetrics and Gynecology Department, Faculty of Medicine , Beni-Suef University, Egypt

Obstetrics and Gynecology Department, Faculty of Medicine , 6 October University, Egypt

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Corresponding Author:

Eman Zein Elabdeen Farid

dremanfarid71@hotmail.com

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Abstract

In this study we concluded that usefulness of sonographic umbilical cord thickness, interventricular septum thickness and HbA1c in prediction of fetal macrosomia in Patients with gestational diabetes mellitus. Umbilical cord area measurement may be combined with the standard fetal biometric parameters to improve the accuracy of identification of fetal macrosomia, allowing it to be better managed without unnecessary intervention, while possibly avoiding permanent injury. Fetal hyperinsulinism in combination with the normally increased expression and affinity of fetal insulin receptors can lead to proliferation and hypertrophy of cardiac myocytes. Hypertrophic cardiomyopathy is characterized by thickening of the interventricular septum, and to a lesser degree, the ventricular free walls. It is usually asymptomatic and

resolves within the first year of life,. The rate of meconium aspiration and the need for mechanical ventilatory support are increased in this group of neonates. Maternal complications such as postpartum hemorrhage, infections, aswell as third- or fourth-degree vaginal lacerations may occur as a result of operative delivery

1. Introduction:

Gestational diabetes mellitus (GDM) is accompanying with a raised risk for opposing maternalas well as newborn outcomes (**1).**

Embryonic macrosomia impacts about 20 to 30 % of gestations with GDM **(2**).

Motherly complications like postpartum hemorrhage, infections, in addition to 3rd or 4th degree vaginal lacerations can happen owing to surgical deliveries **(3**).

The delivery of a fetus with macrosomia was accompanying with opposing results for mothers as well as fetuses shoulder dystocia throughout birth and connected newborn death and morbidities are greater in macrosomia fetuses in comparison to standard weight fetuses **(4**).

The existence of Hyper-glycemia impacts bio-chemical transformations in the fetuses **(5**).

Furthermore, maternal DM persuades placental genes connected to chronic stress inflammation and latest data propose the placental function of inflammations for embryopathy connected to motherly DM **(6**).

The myocardial tissues are the most expected structure influenced by hyper-glycemia. The ventricular free walls are lesser influenced by hyper-trophy in comparison to interventricular septum **(7**).

2. Patients and Methods

This study was a case-control resaerch carried out at Obstetrics and Gynecology outpatient clinic at Beni-Suef University Hospital and 6th october University hospital from 1st July 2019 to 1st january 2020

The study was conducted on 60 preganat females that were divided into: (Study group): 30 with gestational diabetes melitus. (Control group) : 30 healthy control.

Inclusion criteria:

Singleton pregnancy, pregnancy ages between (27 W _ 36 W), intact

membranes, regular umbilical morphology (2 arteries and 1 vein) and for the study group diagnosis of GDM

Exclusion criteria:

The existence of embryonic congenital irregularities, multi-fetal gestation, motherly chronic disorders (high blood pressure, renal disorder, cardiac and pulmonary disorder, etc.), cases with a diagnosing like: placenta previa, oligohydramnios, pre-eclampsia and intra-uterine growing retardation and cases who smoke cigarettes or drinking alcohol throughout gestation.

Controls were chosen randomly from any other outpatient clinic

Methods:

All cases were exposed to the next:

1. Detailed personal, obstetric and medical history involving:

Personal history including age , smoking and level of education, **obstetric history** including gravidity , parity, number of abortions , modes of delivery in previous pregnancies , first day of the last normal menstrual period and the gestational age , onset , duration and frequency of labor pains , urinary symptoms (dysurea , frequency , urgency) , vaginal discharge (color , itching) and **medical history** including Present or Past history of any chronic illnesses (renal, hypertensive, diabetics, hepatic, cardiac.)

2- Examination: Fundamental signs: BP, pulse and temperature, Weight, tallness, BMI and abdominal examination for assessment of fundal level and fetal heart sounds.

3- determination of pregnancy age was built on the date of their last dependable menstrual period according to Naegele's rule and approved by US examinations in the 1st trimester.

4- Lab assessment: Blood sample to measure HbA1c and Fasting blood sugar and 2h postprandial. HbA1c levels were measured at 27 - 36 weeks. Measurement of HbA1c may show as to how high the blood glucose was on an average, over the previous 8 to12-wks.

5- Ultrasound assessment: Sonographic examination was conducted in all study subjects at 27-36 gestational weeks with Voluson E6 prepared with a 3.5 Hz trans-abdominal probe. The inter-ventricular septum thickness was determined. HbA1c levels were determined for DM cases. Cases have been followed-up until time of birth. The newborns were weighed and embryonic macrsomia was detected if embryonic weight is 4000 gm or more.

Administrative design:

An informed verbal agreement from parents of the contributors was taken and secrecy of data was guaranteed. An

official written administrative approval letter was gotten from dean of faculty of medicine, hospitals managers, Head of the obstetrics and Gynecology department in both Beni-Suef University and 6th october University. The objectives of the study were clarified to them to confirm their collaboration.

Ethical committee: Permission from the faculty of medicine ethical committee was also obtained.and approval from institutional review board was taken.

Statistical analysis of the data: the data was analyzed via IBM SPSS-20 (Inc., Chicago, IL, USA). The Kolmogorov-Smirnov testing has been utilized to confirm the normality of distribution. Quantitative data have been presented as range (min and max), mean, standard deviation (SD), median and inter-quartile range (IQR). Significance of the results was counted at the level of 5%.

3. Results:

This table shows that the mean IVS diameter of GDM group was 0.85 cm (±0.27 SD). In the control group the mean IVS diameter was 0.53 cm (±0.12 SD). A highly significant change was found among the study groups regarding IVS diameter. **Table (1)**

This table shows that among GDM cases there were fourteen patients (46.7%) who were macrosomic babies. In the control group there were no macrosomic babies. There was high statistically significant difference between the studied groups as Macrosomic. **Table (2)**

This table shows that the mean age of Macrosomia group was 31.21 years (±5.86 SD), the mean Gestational age by last menstrual period was 31.71 weeks (±4.38 SD) and the mean Gestational age by US was 32.86 weeks (±3.84 SD). In the no macrosomia group the ages mean was 31.04-yrs (±7.22 SD), the mean Gestational age by last menstrual period was 30.96 weeks (±2.91 SD) and the mean Gestational age by US was 31.65 weeks (±2.92 SD). A nonsignificant change was found among the study groups regarding Age, Gestational age. **Table (3)**

This table shows that the mean IVS diameter of Large for gestational age (Macrosomia) group was 0.89 cm (±0.23 SD). In the No macrosomia group the mean IVS diameter was 0.63 cm (±0.24 SD). A significant change was found among the study groups regarding IVS diameter. **Table (4)**

This table shows that the mean HbA1c of Large for gestational age

(Macrosomia) group was 7.47% (±0.59 SD). In the No macrosomia group the mean HbA1c was 5.43% (±0.61 SD). A highly significant change was found among the study groups regarding HbA1c. **Table (5)**

This table shows that the mean Birth weight of Large for gestational age (Macrosomia) group was 4.4 kg (±0.22 SD). In the No macrosomia group the mean Birth weight was 3.24 kg (±0.26 SD). A highly significant change was found among the study groups regarding Birth weight. **Table (6)**

Table (1): Comparing among the study groups as regard IVS diameter

	Control group (n=30)	Gestational DM group (n=30)	*P-value*
IVS diameter (cm)	0.53 ± 0.12	0.85 ± 0.27	**<0.001***

Table (2): Comparing among the study groups as regard Macrosomic babies

	Control group (n=30)		Gestational DM group (n=30)		*P-value*
Macrosomic babies	**no**	**%**	**No**	**%**	**<0.001***
No	**30**	**100.0**	**16**	**53.3**	
Yes	**0**	**0.0**	**14**	**46.7**	

Table (3): Comparing among the study groups as regard characteristics of patients

Variable	Large for gestational age (Macrosomia) (n=14)	Average for gestational age (No macrosomia) (n=46)	Pvalue
Age (years)	31.21 ± 5.8	31.04 ± 7.22	0.936
Gestational age by LMP (weeks)	31.71 ± 4.3	30.96 ± 2.91	0.455
Gestational age by US (weeks)	32.86 ± 4.4	31.65 ± 2.92	0.239

χ^2: **Chi square testing** **t: Student t-testing**
p: p-value for comparison among the study groups

Table (4): Comparing among the study groups as regard IVS diameter

	Large for gestational age (Macrosomia) (n=14)	Average for gestational age (No macrosomia) (n=46)	*P-value*
IVS diameter (cm)	0.89 ± 0.23	0.63 ± 0.24	**0.001***

Table (5): Comparing among the study groups as regard HbA1c

	Large for gestational age (Macrosomia) (n=14)	Average for gestational age (No macrosomia) (n=46)	*P-value*
HbA1c (%)	7.47 ± 0.59	5.43 ± 0.61	**<0.001***

Table (6): Comparing among the study groups as regard Birth weight

	Large for gestational age (Macrosomia) (n=14)	Average for gestational age (No macrosomia) (n=46)	*P-value*
Birth weight (kg)	4.40 ± 0.22	4.40 ± 0.22	**<0.001***

4. Discussion:

Fetal macrosomia is accompanying with an elevated incidence of surgical births, postpartum hemorrhages, delivery injuries in vaginal labour and newborn hypoglycemia. Recognized motherly risk factors are only detected in 40% of cases who born macrosomic fetuses **(*8*).**

GDM impacts about 2- 6% of pregnancies and is accompanying with raised risk of significant opposing perinatal results, involving macrosomia and delivery injuries **(*9*).**

Consequently, for the avoidance of traumatic delivery and opposing results, several researches were accomplished to predict the delivery weight precisely. Through the precise estimate of macrosomic babies that have risk of traumatic delivery, the way of birth can be transformed. US-based birth weight prognostication is still inadequate. Investigators have tried to upgrade US-based predictions of embryonic macrosomia by different approaches **(*10*).**

In the study in our hands we found that a highly significant change was found among the study groups regarding IVS diameter.

Abdelrahman et al. (11) found that there is a rise in inter-ventricular septal thickness (0.85±51) cm in diabetic patients, in which there is high significant change among both groups which goes with our study.

In this study we found that a highly significant change was found among the study groups regarding birth weights.

Binbir et al. (12) found that birth weight did not differ between groups, in which there is nonsignificant change among diabetic and controls which is against this study.

In this study we demonstrated that among GDM cases there were fourteen patients (46.7%) who were macrosomic babies. In the control group there were no macrosomic babies, there was highly significant change among both groups regarding Macrosomic.

Binbir et al. (12) found that the embryonic macrosomia rate was 14.6% (6/41) in the studied group and 10% (5/50) in the controls. The relative risk of macrosomia in the studied group was revealed to be 1.5-fold greater than in the controls.

Naylor et al. (13) were concluded that the frequency of macrosomia was 16–29% in GDM-cases and 10% in the ordinary populations. The relative risk of macrosomia fluctuates from 1.5 to 3-fold greater in the DM populations.

Fayez et al. (14) found that 6 of 41 (14.6%) GDM-cases or pre-GDM born macrosomic babies, while 5 of 50 (10%) babies born by non-DM cases were macrosomic. The comparative risk of macrosomia for the DM-group was revealed to be 1.5-fold greater.

In study in our hands, we found that there was statistically nonsignificant change among the Macrosomic and non-Macrosomic regarding Age, Gestational age.

Fayez et al. (14) found that the maternal age did not differ significantly between both groups, most of them were between 20 and 30 years of age (36%, 39%, respectively), and however, still no significant difference was noted when compared the proportions in the two groups. Macrosomic group had a mean maternal age of 26.6 ± 4.4 years, non- macrosomic group had a mean maternal age of 27.1 ± 3.8 years and the total sample had a mean maternal age of 27.2 ± 4.1 years old. As regards the gestational age at delivery, the total sample had a mean gestational age 37.1 ± 1.2 weeks; nonsignificant change was fond which goes with our study.

In this study we demonstrated that a significant change was found among the macrosomia and non-macrosomia groups regarding IVS diameter.

Fayez et al. (14) found that there was high significant change among both groups regarding IVS diameter which goes with our study.

In the study in our hands, we found that a high significant change was found among the macrosomia and non-macrosomia groups regarding HbA1c.

Fayez et al. (14) revealed that macrosomic group had a greater HbA1c levels than control group (6.4 ± 0.3% vs 5.8 ± 0.4 %, respectively), which was highly statistically significant ($p < 0.0001$), while the total sample had a mean of 6.1 ± 0.3% which goes with our study.

Binbir et al. (12) found that HbA1C levels weren't statistically different for macrosomic babies in comparison to non-macrosomic babies ($P = 0.701$) which is against this study.

In this study we demonstrated that a high significant change was found among the macrosomia and non-macrosomia groups as regard Birth weight.

Fayez et al. (14) found that both groups differed in the birth weight of the delivered fetuses, group 1 had a mean birth weight of 3924.9 ± 418.3 gm (for 15 fetuses) versus 3332.3 ± 296.1 gm (for 85 fetuses), which was highly significant ($p < 0.01$) which goes with our study.

The present work has some restrictions that must be taken in to consideration when assessing our findings. Small number of the investigated group can affect the findings; large numbers of cases can strengthen the findings, additional studies are desired to evaluate the clinical value of these soft tissues measurements in formulas for estimation of embryonic weight.

5. Conclusion:

In this study we concluded that usefulness of sonographic interventricular septum in predicting the embryonic macrosomia in GDM-cases. Inter-ventricular septum measurements can be joint with the normal embryonic biometric factors to upgrade the accuracy to identify the embryonic macrosomia, permitting for better management with no additional interventions, while maybe prevent permanent injuries.

Conflict of Interest: The Authors declare that there is no conflict of interest

6. References:

1. **Abdelrahman, R. M., & Salama, M. M. (2018).** The role of Umbilical Cord thickness, Interventricular Septum thickness and HbA1c levels in the prediction of Fetal Macrosomia in patients with Gestational Diabetes Mellitus. J Gynecol Res Obstet, 4(3), 039-043.
2. **Billionnet, C., Mitanchez, D., Weill, A., Nizard, J., Alla, F., Hartemann, A., & Jacqueminet, S. (2017).** Gestational diabetes and adverse perinatal outcomes from 716,152 births in France in 2012. Diabetologia, 60(4), 636-644.
3. **Binbir, B., Yeniel, A. O., Ergenoglu, A. M., Kazandi, M., Akercan, F., & Sagol, S. (2011).** The role of umbilical cord thickness and HbA1c levels for the prediction of fetal macrosomia in patients with gestational diabetes mellitus. Archives of Gynecology and Obstetrics, 285(3), 635–639.
4. **Fayez Mohamed Fathi, M., Mohammed Moustafa, T., & Ramadan Alsawy Rady, I. (2020).** The role of umbilical cord thickness and glycated hemoglobin (hba1c) levels for prediction of fetal macrosomia in patients with gestational diabetes mellitus. Al-Azhar Medical Journal, 49(4), 1741-1752.
5. **Gandhi, J. A., Zhang, X. Y., & Maidman, J. E. (1995).** Fetal cardiac hypertrophy and cardiac function in diabetic pregnancies. *American journal of obstetrics and gynecology*, *173*(4), 1132-1136.

6. **Helm, B. M., & Freeze, S. L. (2016).** Genetic evaluation and use of chromosome microarray in patients with isolated heart defects: benefits and challenges of a new model in cardiovascular care. *Frontiers in cardiovascular medicine*, *3*, 19.
7. **He, X. J., Qin, F. Y., Hu, C. L., Zhu, M., Tian, C. Q., & Li, L. (2015).** Is gestational diabetes mellitus an independent risk factor for macrosomia: a meta-analysis?. *Archives of gynecology and obstetrics*, *291*(4), 729-735.
8. **Inegbenebor, U., & Okosun, J. (2019)** Identifying maternal nutritional risk factors associated with fetal macrosomia in Nigeria. Obstet Gynecol Int J, 10(3), 185-190.
9. **Liabsuetrakul, T., Choobun, T., Peeyananjarassri, K., & Islam, Q. M. (2017).** Antibiotic prophylaxis for operative vaginal delivery. *Cochrane Database of Systematic Reviews*, (8).
10. **Said, A. S., & Manji, K. P. (2016).** Risk factors and outcomes of fetal macrosomia in a tertiary centre in Tanzania: a case-control study. *BMC pregnancy and childbirth*, *16*(1), 243.
11. **Lipshultz, S. E., Law, Y. M., Asante-Korang, A., Austin, E. D., Dipchand, A. I., Everitt, M. D., ... & Colan, S. D. (2019).** Cardiomyopathy in children: Classification and diagnosis: A scientific statement from the American Heart Association. *Circulation*, CIR-0000000000000682.
12. **Júnior, E. A., Peixoto, A. B., Zamarian, A. C. P., Júnior, J. E., & Tonni, G. (2017).** Macrosomia. Best Practice & Research Clinical Obstetrics & Gynaecology, 38, 83-96.
13. **Naylor, C. D., Sermer, M., Chen, E., & Sykora, K. (1996).** Cesarean delivery in relation to birth weight and gestational glucose tolerance: pathophysiology or practice style?. Jama, 275(15), 1165-1170.
14. **Ogonowski, J., & Miazgowski, T. (2015).** Intergenerational transmission of macrosomia in women with gestational diabetes and normal glucose tolerance. European Journal of Obstetrics & Gynecology and Reproductive Biology, 195, 113–116. doi:10.1016/j.ejogrb.2015.10.002