Cardiac Abnormalities in Fetuses of Diabetic Mothers

Thesis
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بِسْمِ اللّهِ الرّحمَنِ الرّحيمِ

(...رَبِّ أَوزِعنِي أَن أَشكُرَ نِعمَتَكَ الّتِي
أَنْعَمْتَ عَلَيَّ وعَلى والِدَيَّ
وَأنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وأَدْخِلْنِي
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

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List of Contents

Subject *Page No.*

List of Abbreviations ..... **i**

List of Tables ..... **ii**

List of Figures ..... **v**

Introduction **1**

Aim of the Work **3**

Review of Literature

Pregnancy & Diabetes 4

Impact of Maternal Diabetes on Fetal Development 11

Fetal Cardiac Abnormalities of Diabetic Mother 21

Fetal Echocardiography 40

Fructosamine 64

Patients and Methods **72**

Results **78**

Discussion **93**

Summary **102**

Conclusion **106**

Recommendations **108**

References **108**

Arabic Summary ..... **—**

List of Abbreviations

2D…….Two-dimensional

3D…….Three-dimensional

4D……..Four-dimensional

ADA……..American Diabetes Association

AO…….Aorta

AVSD……Atrioventricular septal defect

BSA……...Body surface area

CAT……..Common arterial trunk

CM……Cardiomyopathy

DM…….... Diabetes mellitus

DORV……...Double outlet right ventricle;

EM……....Epithelio-mesenchymal

GCT……..Glucose challenge test

GDM…….Gestational diabetes mellitus

HAPO ……..….Hyperglycemia and Adverse Pregnancy Outcomes

HbAlc……....Glycosylated hemoglobin

HCM…….Hypertrophic cardiomyopathy

HDL…….High-density-lipoprotein

HLHS……....Hypoplastic left heart syndrome

IAA……Interrupted aortic arch

IADPSG ……....The International Association of the Diabetes and Pregnancy Study Groups

IDM…….. Infant of a diabetic mother

IUGR……....Intrauterine growth restriction

IVST……..Interventricular septal thickness

LA……..Left atrium

LDL……...Low-density-lipoprotein

LGA…….....Large for gestational age

LV…….Left ventricle

NAFLD……Non alcoholic fatty liver disease

NASH……...Inflammatory steatohepatitis

NBT……..Nitroblue tetrazolium colorimetric

NTB……..Nitrotetrazolium-blue

OGTT……...Oral glucose tolerance test

OR…….....Odds ratio

PA……..Pulmonary artery

PVH……...Pathologic ventricular hypertrophy

PVH……...Pathologic ventricular hypertrophy

PVPI……..Pulmonary vein pulsatility index

RA……..Right atrium

RBCs…….Red blood cells

RV……..Right ventricle

SGA……...…Small for gestational age

SSA……...Anti-Ro

SSB……...Anti-La

T1DM ……Type 1 diabetes mellitus

T2DM ……Type 2 diabetes mellitus

TBA……Thiobarbituric acid colorimetric

TDI……..Tissue Doppler imaging

TGA…….Transposition of the great arteries

TGA……Transposition of great arteries

TOF&PA……Tetralogy of Fallot with pulmonary atresia

TOF……..…Tetralogy of Fallot

TTTS…….....Twin-twin transfusion syndrome

VSD……..Ventricular septal defect

List of Tables

Table No.	Title	Page No.
Table (1):	Perinatal mortality and neonatal morbidity in infants of diabetic mothers	12
Table (2):	Congenital anomalies associated with infants of diabetic mothers	18
Table (3):	Common indications for fetal echocardiography	42
Table (4):	General recommendations for fetal echocardiography	44
Table (5):	Essential components of the fetal echocardiogram	46
Table (6):	Comparison between group I and group II as regards demographic data	78
Table (7):	Comparison between group I and group II as regards laboratory data	79
Table (8):	Comparison between group I and group II as regards echocardiographic data	79
Table (9):	Comparison between group Ia and group Ib as regards demographic data	81
Table (10):	Comparison between group Ia and group Ib as regards laboratory data	81
Table (11):	Comparison between group Ia and group Ib as regards echocardiographic data	82
Table (12):	Comparison between group Ic and group Id as regards demographic data	84
Table (13):	Comparison between group Ic and group Id as regards Hb A1c levels	84

List of Tables *(Cont.)*

Table No.	Title	Page No.
Table (14):	Comparison between group Ic and group Id as regards echocardiographic data	85
Table (15):	Correlation between maternalage, gestational age, number of birth and descriptive, laboratory and echocardiographic data	86
Table (16):	Correlation between HbA1c,S.fructosamine levels and descriptive, laboratory and echocardiographic data	87

List of Figures

Figure No.	Title	Page No.
Figure (1):	Cells from the epiblast detach and migrate through the primitive groove to form the endoderm and mesoderm layers	22
Figure (2):	The single heart tube shows constrictions outlining future structures	24
Figure (3):	Looping of the single endocardial heart tube transforms it into a complex fourchamber structure	26
Figure (4):	One heart disease—several mechanisms—several genes (Bajolle et al., 2009)	28
Figure (5):	Tetralogy of Fallot. Outflow tract view shows aorta (AO) overriding ventricular septal defect	30
Figure (6):	Trunucus arteiosus	31
Figure (7):	Fetal cardiomyopathy	33
Figure (8):	Double Outlet RV	34
Figure (9):	Hypoplastic left heart syndrome	35
Figure (10):	Ventricular Septal Defect (Rajia et al., 2011)	36
Figure (11):	AV Septal Defect (Barboza et al., 2002).	36
Figure (12):	Illustration of the tomographic planes used to image the fetal cardiovascular system	47
Figure (13):	Illustrations of the anatomical correlates for each of the designated tomographic imaging planes used for imaging of the fetal cardiovascular system	48

List of Figures *(Cont.)*

Figure No.	Title	Page No.

Figure (14): Tetralogy of Fallot. 54

Figure (15): D-transposition of great arteries.....56

Figure (16): Hypoplastic left heart syndrome. 57

Figure (17): Hypoplastic aorta 58

Figure (18): Truncus arteriosus 59

Figure (19): Atrioventricular canal defect.....60

Figure (20): Double outlet right ventricle 61

Figure (21): Dilated cardiomyopathy.....62

Figure (22): Hypertrophic cardiomyopathy 62

Figure (23): Ventricular septal defect 63

Figure (24): The reaction of glucose and protein to form fructosamine.....65

Figure (25): Pulmonary vein flow assessment 75

Figure (26): Septal tissue Doppler (TDI) 76

Figure (27): Distribution of maternal illness during pregnancy in group I 78

Figure (28): Distribution of Hb A1c values in studied groups.....80

Figure (29): Distribution of serum fructosamine values in studied groups 83

Figure (30): Correlation between pulmonary vein pulsatility index(PVPI) andinterventricular thickness (IVST) in group I. 88

List of Figures *(Cont.)*

Figure No.	Title	Page No.

Figure (31): Correlation between interventricular septal thickness (IVST) (cm) and gestational age (GA)(weeks) in group I. 89

Figure (32): Correlation between HBA1c levels (%) and pulmonary vein pulsatility index (PVPI) in group I. 89

Figure (33): Correlation between HBA1c levels (%) and interventricular septal thickness (IVST)(cm) in group I. 90

Figure (34): Correlation between HBA1c levels (%) and serum fructosamine levels (µmol/L) in group I. 90

Figure (35): Correlation between HBA1clevels (%) and gestational age (GA) (weeks) in group I. 91

Figure (36): Correlation between serum fructosamine levels (µmol/L) and pulmonary vein pulsatility index (PVPI) in group I. 91

Figure (37): Correlation between serum fructosamine levels (µmol/L) and gestational age (GA) (weeks) in group I. 92

Figure (38): Correlation between serumfructosamine levels andinterventricular septal thickness (IVST) in group I. 92

Introduction

The consequences of uncontrolled diabetes mellitus (DM) during pregnancy are severe to both mother and fetus. The risk of congenital malformations among infants of diabetic mothers is related to the diabetic control these mothers receive ***(Alien et al., 2007).***

Maternal DM affects the fetal heart both structurally and functionally. In early gestation, it has a teratogenic effect causing primary cardiogenesis defects. In late gestation, it causes a unique form of hypertrophic cardiomyopathy ***(Chaudhari et al., 2008).***

Cardiomegaly is a common finding in stillborn infants of mothers with DM and may contribute to the risk of fetal death in these pregnancies ***(Russell et al., 2008).***

Given the increased risk of congenital abnormalities among infants of diabetic mothers, an appropriate biochemical and ultrasonographic screening process and a detailed evaluation of fetal cardiac structure should be offered to all pregnant women with diabetes ***(Wilson et al., 2007).***

The timing of development of the myocardial changes in the fetus of the diabetic mother has been well demonstrated by fetal echocardiography. Fetal echocardiographic investigations suggest the onset of hypertrophy occurs even before 20 weeks of gestation with documentation of increased ventricular septal

thickening relative to fetuses in non diabetic pregnancies ***(Macklon et al., 1998).***

Fructosamines are keto-amines formed by a non-enzymatic reaction between glucose and a protein (60-70% of which is glycosylated with albumin in serum), depending upon the severity and the duration of the hyperglycemia. Therefore, serum fructosamine directly reflects the dynamics of blood glucose concentration and correlates significantly with the mean plasma glucose levels from the preceding 1 to 3 weeks ***(Weerasekera et al, 2000).***

Fructosamine testing has been available since the 1980s. Both fructosamine and HbAlc are used primarily as monitoring tools to help diabetics control their blood sugar, but the A1C test is much more popular and more widely accepted. However, the American Diabetes Association (ADA) recognizes both tests and says that fructosamine may be useful in situations where the A1C cannot be reliably measured ***(Goldstein et al, 2004).***