Interventricular cardiac septal thickness in fetus of diabetic mother correlated to postnatal outcome

Thesis

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سماكه الحاجز القلبي لجنين إلام المصابة بمرض السكر وتأثيره على وظيفية القلب بعد الولادة

رسالة

توطئه للحصول على درجه الماجستير في أمراض النساء والتوليد

مقدمه من

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Heba Mohamed Elasyed

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List of Abbreviations

ADA	American Diabetes Association
ASD	Atrial septal defect
AV	Atrioventricular
BAS	Balloon atrial septostomy
Echo	echocardiography
CHD	congenital heart disease
CVO	Combined ventricular output
DA	ductus arteriosus
FODM	Fetus of diabetic mother
FE	Fetal echocardiography
GDM	Gestational diabetes mellitus
HbF	Fetal hemoglobin
PFC	persistent fetal circulation
HCM	Hypertrophic cardiomyopathy
IDF	International Diabetes federation
IDM	Infant of diabetic mother
IFT	Impaired fasting glucose
IGT	Impaired glucose tolerance
IUFD	Intrauterine fetal death
IUGR	Intra Uterine growth retardation
IVC	Inferior vena cava
IVS	Interventricular septum
LA	Left atria
LV	Left ventricle
LVOT	left ventricular outflow tract
MRI	magnetic resonance imaging
OGTT	Oral glucose tolerance test
PA	pulmonary artery
PDA	Patent ductus arteriosus
PGE1	Prostaglandin E1

PGE2	Prostaglandin E2
PVH	Pathological ventricular hypertrophy
PVR	pulmonary vascular resistance
PFC	Persistent fetal circulation
RCT	Randomized controlled trial
ROC	Receiver Operating Characteristic
RV	Right ventricle
RA	Right atria
SVC	Superior vena cava
SVR	Systemic vascular resistance
TGA	Transposition of the great arteries
TOF	Tetra logy of Fallot
VSD	Ventricular septal defects
vs	Versus

Introduction

Pregnancy is associated with changes in insulin sensitivity which may lead to changes in plasma glucose levels. For women with known diabetes or for women who develop diabetes during the pregnancy, these changes can put outcomes at risk. ***(IDF Clinical Guidelines Task Force. 2005).***

In the majority of cases, the frequency of the various complications that may affect mother or child can be controlled with appropriate diagnosis and management. As mentioned above, control of blood glucose levels during pregnancy is extremely important. Conventionally, the patient undergoes in-patient education with diet therapy, and if the target blood glucose levels low is not achieved, the patient should be treated with insulin therapy***. (Manderson, et al.; 2003).***

Impaired maternal glucose tolerance is associated with several complications including fetal macrosomia, growth restriction, neonatal hypoglycemia, respiratory distress syndrome and hypertrophic cardiomyopathy ***(Sardesai, et al., 2001).***

The fetal heart is threatened in a double fashion. First, at the beginning of gestation, the diabetes has a teratogenic effect, cardiogenesis is impaired in the correct expression of genes coding for the cardiac development. ***(Molin, et al., 2004)***

The Second, starting at the end of the second or beginning of the third trimester, the fetus may be affected by patho-

logic ventricular hypertrophy (PVH), commonly referred as hypertrophy cardiomyopathy. ***(Allan et al., 2000)***

The alternation resulting from maternal diabetes are due to fetal hyperinsulinaemia associated with an increase in the number of insulin receptors in the heart, leading to hyperplasia and hypertrophy of myocardial cells, because of the increase in protein and fat synthesis. ***(Menezes et al; 2001)***

Fetal Hypertrophic cardiomyopathy may develop at various stages of gestation. The frequency of fetal cardiomyopathy is estimated to be 2-4% among all cardiac anomalies Cardiomyopathy may result in serious adverse effects, such as cardio-circulatory insufficiency, or may lead to intrauterine fetal death ***(Simpson. 2008).***

A characteristic feature of hypertrophic cardiomyopathy in infants of diabetic mothers is hypertrophy of the ventricular and septal walls. One of the studies showed that 5% of affected newborns of diabetic mothers had congestive heart failure secondary to left ventricular outflow obstruction. Cardiac hypertrophy is transient with spontaneously echocardiographic resolution within the first months after birth, irrespective of therapy ***(Mormile, et al., 2011)***

Hypertrophic septal cardiomyopathy is one of the common anomalies with diabetes, so high index of suspicion is required as the specific management may vary and digoxin, or inotropic agents which may be used in heart failure associated with structural heart defects are contraindicated if hypertrophic cardiomyopathy is present ***(Narchi and Kulaylat, 2000).***

Measuring the Interventricular septum area is of particular importance in fetuses at risk for hypertrophic cardiomyopathy, such as the children of diabetic mothers, where there is significant thickening of the Interventricular septum, causing obstructions in the left ventricular outflow tract. ***(Abu-Sulaiman, Subaih; 2004).***

Aim of the work

To study Interventricular septal thickness in fetus of diabetic mother and correlate it with good glycemic control.

To correlate postnatal cardiac function to Interventricular septal thickness to reach cut off value of septal thickness for prenatal prediction of symptomatic hypertrophic cardiomyopathy in infant of diabetic mother.

CARDIOVASCULAR EMBRYOLOGY

These last two decades have seen a wealth of new information concerning heart development. Previously, our knowledge of cardiac development was essentially based on the analysis of series of embryo sections and three dimensional reconstructions so as to clarify the anatomy of certain regions that were difficult to interpret on simple sections. The use of these techniques does not allow either to follow the outcome of a group of cells or to accurately distinguish the development mechanisms of a given cardiac chamber, the atrioventricular junction or even the efferent pathway (***Meilhac et al., 2004).***

As a result of hemodynamic environment changes, there are alterations in multiple mechanical signals (hydrostatic pressure, strain, fluid shear, etc.) in the heart. Such changes in mechanical stimuli have been shown to drive changes in cell function in adult cardiac cells ***(Butcher et al., 2006).***

Embryonic Folding Early in the third week of development, the germ disk has the appearance of a flat oval disk and is composed of two layers: the epiblast and the hypoblast. The first faces the amniotic cavity and the latter faces the yolk sac. A primitive groove, ending caudally with the primitive pit surrounded by a node, first appears at approximately 16 days of development and extends half the length of the embryo. The primitive groove serves as a conduit for epiblast cells that de-

tach from the edge of the groove and migrate inwards toward the hypoblast and replace it to form the endoderm. After the endoderm is formed, cells from the epiblast continue to migrate inwards to infiltrate the space between the epiblast and the endoderm to form the intraembryonic mesoderm. After this process is complete, the epiblast is termed the ectoderm (***Hogers et al., 2009). (Fig. 1).***

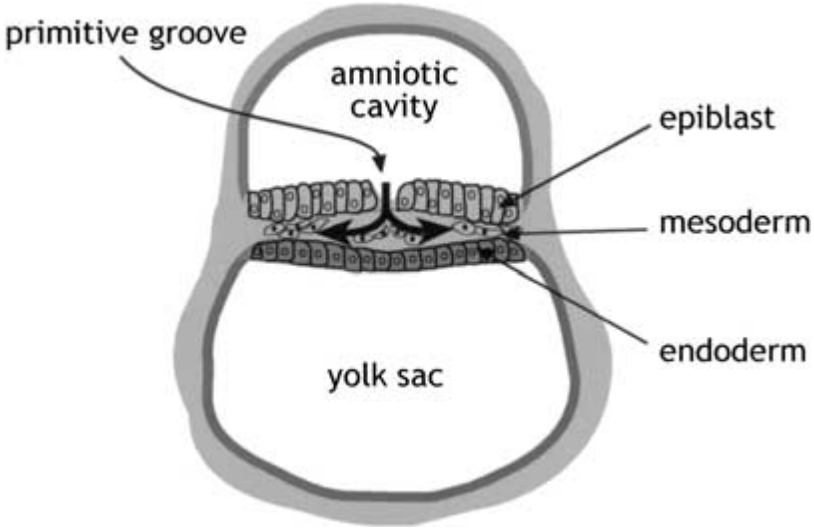

Fig. 1. Cells from the epiblast detach and migrate through the primitive groove to form the endoderm and mesoderm layers **(*Hogers et al., 2009).***

The flat germ disk transforms into a tubular structure during the fourth week of development ***(Butcher et al., 2006).***