Prediction of Fetal Lung Maturity in Diabetic Women by Pulmonary Artery Doppler study (Controlled Clinical trial)

Thesis

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By

Ebtesam Refaat Ebrahim Ali

M.B.B.Ch

Faculty of Medicine- Ain Shams University 2012

Resident in Embaba General Hospital

Supervised by

Dr. Noha Hamed Rabei

Professor of Obstetrics and Gynecology

Faculty of Medicine – Ain Shams University

Dr. Laila Aly Farid

Assistant Professor of Obstetrics and Gynecology

Faculty of Medicine – Ain Shams University

Faculty of Medicine
Ain Shams University
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Ebtesam Refaat Ebrahim

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List of Abbreviations

ADA	:	American Diabetes Association classification
At/Et	:	The acceleration time/ejection time
AUC	:	Area under the ROC curve
BMI	:	Body mass index
BP	:	Blood pressure
CPAP	:	Continuous Positive Airway pressure
CS	:	Cesarean section
DV	:	Ductus venosus
FBS	:	Fasting blood sugar
FGR	:	Fetal growth restriction
FLM	:	Fetal lung maturity
FPAF	:	Fetal pulmonary artery flow
FPG	:	Fasting plasma glucose and
GA	:	Gestational age
GAD	:	Glutamic acid decarboxylase
GBS	:	Group B streptococci
GDM	:	Gestational diabetes mellitus
IAA	:	Insulin autoantibodies,
L/S	:	Lecithin / sphingomyelin
MCA Doppler	:	Middle cerebral artery Doppler
MCA PSV	:	Middle cerebral artery peak systolic velocity
MODY	:	Maturity-onset diabetes of the young
MoM	:	Multiples of the median
MPA	:	Main fetal pulmonary artery
MSAF	:	Meconium-stained amniotic fluid

NICU	:	Neonatal Intensive Care Unit
NRDS	:	Neonatal respiratory distress syndrome
OGTT	:	Oral glucose tolerance test
PBS	:	Postprandial blood sugar
PG	:	Phosphatidyl glycerol
PI	:	Pulsatility index
PPG	:	Postprandial plasma glucose
PSV	:	Peak systolic velocity
RCOG	:	Royal College of Obstetricians and Gynecologists
RDS	:	Respiratory distrss syndrome
RI	:	Resistance index
ROC	:	Receiver-operating characteristic
S/D	:	Systolic/diastolic
SGA	:	Small for their gestational age
TTTS	:	Twin-to-twin transfusion syndrome
UA	:	Umbilical artery
UV	:	Umbilical vein

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Introduction

Diabetes mellitus complicates 3–5% of all pregnancies and is a major cause of perinatal morbidity and mortality, as well as maternal morbidity **(Ahmed et. al., 2015).**

Neonatal respiratory distress syndrome (RDS) refers to respiratory compromise presenting at or shortly after delivery related to a deficiency of pulmonary surfactant, a naturally occurring phospholipid required to decrease surface tension within the alveoli to prevent alveolar collapse **(Azpurua et al., 2010).**

Risk of neonatal RDS decreases as gestational age increases, because the lungs are the final fetal organs to functionally mature. Therefore, neonatal RDS is often considered to be a disease of premature newborns, although it does not exclusively occur after preterm deliveries **(Laban et al., 2015).**

Preterm deliveries can follow spontaneous onset of labor with or without preterm rupture of membranes; however, preterm deliveries are, sometimes, provider-initiated. Deliveries can be unintentionally preterm because of gestational age (GA) error as commonly seen in women delivered by elective Cesarean section (CS) **(Moety et al., 2015).**

In several conditions, obstetric care providers, decide to terminate pregnancy before spontaneous delivery is begun. One of the most concerns for determining the optimal time for pregnancy termination, in high risk pregnancies, is, detecting those fetuses which are at risk for RDS. Several methods are described to evaluate fetal lung maturity (FLM) such as measurement of the lecithin / sphingomyelin (L/S) ratio, presence or absence of phosphatidyl glycerol (PG), fluorescent polarization test, foam stability or shake test and lamellar body count in amniotic fluid which requires amniocentesis, an invasive procedure, and associated with a small but real risk to pregnancy, including preterm labor, premature rupture of membrane, abruption plancenta, and fetomaternal hemorrhage, in 0.7% of cases and (rarely) fetal or maternal mortality **(Fariba et al., 2016).**

For these reasons, noninvasive methods using ultrasound to assess fetal lung maturity have long been sought for, but efforts to date (such as measurements of lung volumes, gestation age, epiphysis centers, placental grading, and estimated fetal weight) have been unsuccessful in clinical practice.As the lungs develop throughout gestation, so does the pulmonary vasculature, where both the absolute number of pulmonary arteries rises and the total amount of smooth muscular tissue increases, and the pulmonary arterial vascular resistance decreases slightly, leading to a gradual increase in pulmonary blood flow **(Guan et al., 2015).**

Previous studies have shown predictable changes of fetal lung echogenicity during pregnancy **(Tekesin et al., 2004)** and fetal pulmonary artery Doppler waveforms in hypoplastic fetal lungs **(Chaoui et al., 1998, Fuke et al., 2003)** and progressive increase in ratio correlate with advancing gestational age.

Recent studies have demonstrated that Acceleration /Ejection time ratio in fetal main pulmonary artery can predict fetal lung maturity as measured by biochemical tests of amniocentesis **(Azpurua et al., 2010, Schenone et al.,2014)**or by comparing with clinical outcome of delivered fetuses **(Kim et al., 2013, Guan et al., 2014).**

Aim of the Work

The aim of the work is to assess the accuracy of fetal pulmonary artery Doppler in prediction of fetal lung maturity in diabetic pregnant women.

Research Question:

In diabetic pregnant women, does fetal pulmonary artery Doppler predict lung maturity accurately?

Research Hypothesis:

In diabetic pregnant women, Fetal pulmonary artery Doppler may predict lung maturity accurately.

Outcome measures:

1. Primary outcome measure:

Prediction of respiratory distress syndrome by pulmonary artery Doppler in diabetic pregnant women.

2. Secondary outcome measure:

Fetuses which need Neonatal Intensive Care Unit (NICU) admission, application of Continuous Positive Airway pressure (CPAP), Nasal CPAP, administration of exogenous surfactant therapy or endotracheal tube insertion (mechanical ventilation).

Subjects & Methods

Study Setting:

Faculty of Medicine, Ain Shams University Maternity Hospital.

Expected Duration:

Six months from September 2017 to March 2018 .

Study design:

Controlled Clinical trial (prospective study).

Study Population:

At least 80 pregnant women planned to undergo elective uncomplicated cesarean section.

Sample size:

This study will include 80 women preparing to do fetal pulmonary artery Doppler ultrasound and designed as the following 2 groups:

(Case group): include 40 pregnant women with controlled diabetes mellitus.

(Control group): include 40 pregnant women not complicated with diabetes mellitus.

Sample size justification:

Assuming Null hypothesis that there is no correlation between pulmonary artery peak systolic velocity (PSV) and Respiratory Distress Syndrome (RDS) and the alternative hypothesis is the presence of correlation pulmonary artery PSV and RDS from the previous study the effect size was found to be 0,327 and setting a (two sided) test at 0,05 and 0,3 at 0,1 the sample size was found to be 80 patients to be divided into 2 groups according to **(GAFA Moety et al., 2015)**

Inclusion Criteria:

1- Gestational age is above 37 weeks.
2- Singleton pregnancy.

Exclusion Criteria:

1- Pregnant females less than 37 weeks of gestational age.
2- Multiple pregnancy.
3- Uncertain gestational age.
4- History of cardiac or hypertension disease.
5- Obstetric hemorrhage as antepartum hemorrhage.
6- Intrauterine growth retardation.