Role of Sonographically Measured fetal Abdominal Subcutaneous Tissue Thickness in Estimation of Birth Weight at Term Pregnancy

Thesis

Submitted for Partial Fulfillment of Master Degree
In **Obstetrics and Gynecology**

By

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Acknowledgement

Contents

List of Abbreviations

2D	2 Dimension
AC	Abdominal Circumference
AGA	Appropriate for Gestational Age
AUC	Area Under The Curve
BPD	Bi-Parietal Diameter
BW	Birth Weight
cm	Centimeter
CT	Computed Tomography
DM	Diabetes Mellitus
EFW	Estimated Fetal Weight
FAST	Fetal Abdominal Subcutaneous Tissue Thickness
FL	Femur Length
g	Gram
GA	Gestational Age
HC	Head Circumference
IUGR	Intrauterine Growth Restriction
Kg	Kilograms
LBW	Low Birth Weight
LGA	Large for Gestational Age
MHz	Megahertz
mm	Millimeter
MRI	Magnetic Resonance Imaging
NPV	Negative Predictive Value
p	Power of Significance
PPV	Positive Predictive Value
S	Significant
SD	Standard Deviation
SEM	Standard error of measurement
SGA	Small for Gestation Age
U/S	Ultrasound
Wk	Week

List of Tables

List of Figures

❦ List of Figures ❦

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Protocol of Thesis

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Introduction

For many aspects of perinatology, it is important to ensure that the fetal growth rate is appropriate for the age of the fetus. Abnormal fetal growth can cause prenatal and postnatal complications, and is associated with increased neonatal morbidity and mortality. Therefore, evaluation of fetal intrauterine growth by ultrasound measurements is advisable *(Dashe et al., 2000)*. Many studies have demonstrated that expected fetal weight (EFW) by the traditional techniques is not a reliable indicator of growth abnormalities such as macrosomia, consequently several other echographic measurements have been proposed *(Hoopmann, et al., 2010)*. New sonographic methods are now focused on soft tissue measurments but controversies are already present *(Chauhan, et al., 2000)*. Fetal fat thickness alone has been used to detect macrosomic fetuses at term, thus was used in choosing the mode of delivery *(Kehl, et al., 2012)*.

Measurement of fat in the abdominal wall is a simple technique with a sensitivity for predicting low-birth weight, macrosomia, etc, similar to that of conventional sonography and might potentially predict fetal growth restriction irrespective of fetal weight *(Larkin, et al., 2012)*. Ultrasound-derived fetal weight estimates alone are not sufficient grounds for deciding the route of

delivery. To determine the mode of delivery, the clinical fetalweight estimate, subjective maternal weight estimate and clinical assessment of the pelvic capacity should be added to the sonographic fetal weight estimate, with consideration of the risk factors for macrosomia *(Ben-Haroush, et al., 2004).*This ultrasound examination also helps in the assessment of fetal well-being and fetal growth as well as influencing the clinical decision in determining the best time and mode of delivery *(Nizard, et al., 2009).*

Abnormal fetal growth increases the complications of pregnancy not only for the baby but also for the mother. Growth abnormalities also have lifelong consequencies. These babies are at increased risk of insulin resistance, diabetes and hypertension later in life. It is important to identify these babies antenatally to optimize their clinical care. Although used extensively antenatally to monitor fetal growth, ultrasound has its limitations. Despite the use of more than 50 different formulae to estimate fetal weight, their performance has been poor at the extremes of fetal weight. Over the past 20 years, there has been emerging interest in studying fetal soft tissue measurements to improve the detection of growth abnormalities *(Bonamy, et al., 2011).*

Aim of the Work

Study Hypothesis:

In normal pregnancy at term, fetal abdominal subcutaneous tissue thickness (FASTT) may predict fetal weight accurately.

Research Question:

In normal term pregnancy, does estimation of fetal abdominal subcutaneous fat thickness can predict fetal weight more accurately than current methods?

Objective:

To asses the accuracy of fetal abdominal subcutaneous tissue thickness by ultrasound as a predictor of birth weight.

Medical Application:

If we are able to asses the accuracy of abdominal subcutaneous fat thickness as a new sonographic parameter in calculation of EFW, we can use it as a valuable parameter for sonographic assessment of fetal growth and expected fetal weight.

Patients and Methods

Setting: Ain Shams University Maternity Hospital.

Design: Study for accuracy of a diagnostic test.

Population:

The study will include 400 pregnant women who will be admitted to the labor ward for delivery.

Inclusion criteria:

1. Singleton viable pregnancy.
2. Full term pregnant patients with gestational age 37-41 weeks (based on first day of last menstrual period of regular menstrual cycles, 1st trimesteric or early 2nd trimesteric Ultrasound scan.) referred to labor ward for delivery either for induction or by caesarean section.

Exclusion criteria:

1. Gestational age less than 37 weeks or more than 41 weeks.
2. Multiple pregnancies.
3. Fetal anomalies.
4. IUFD.

Methodology:

All included women after informed consent will be subjected to:

1. Full history taking with special emphasis to maternal age, parity,   maternal weight, gestational age, as well as presence of any disease.
2. Abdominal examination to assess the fundal height and estimated   fetal weight.
3. All ultrasonographic measurements to be performed by one of three sonographers with at least two-year experience in basic   obstetric ultrasonography.
4. All Ultrasonographic examinations will be performed using   a SonoAce Medison X4 ultrasound machine (Samsung   Medison , South Korea) trans-abdominal 3.5 MHz probe, at The Special Care Center for Fetus Unit at Ain Shams University Maternity Hospital.
5. Ultrasound assessment of fetal anatomy and fetal biometry, including
   A. Biparietal (BPD), that is measured on a transverse axial section of the fetal head which includes the falx cerebri anterior and posterior, the cavum septum pellucidum anteriorly in the midline and the thalami. The BPD is measured from the outer edge of the nearer parital bone to the inner edge of the more distant parital bone.
   B. Femur length (FL) is measured with the bone across the beam axis, the strong acoustic shadow behind the femoral shaft and the visualisation of both cartilaginous ends indicates that the image plane is on the longest axis and is the optimal measurement plane. The calipers are placed along the diaphyseal shaft excluding the   epiphysis.

C. Abdominal circumference (AC) is measured at the level of the liver and stomach including the left portal vein at the umbilical region.

6. Measurement of fetal abdomimal fat thickness by ultrasound:

The abdominal circumference plain will be obtained, electronic caliper are used to measure the inner to outer aspect of the echogenic subcutaneous fat that surrounds the abdomen, paraumbilical, 1-2 cm away from the umbilical notch. Measurements are not taken on the fetal back (not in the quadrants which include the spine).The thickness will be measured twice and the average will be taken *(Petrikovsky et al.., 1997)* (Figure 1)
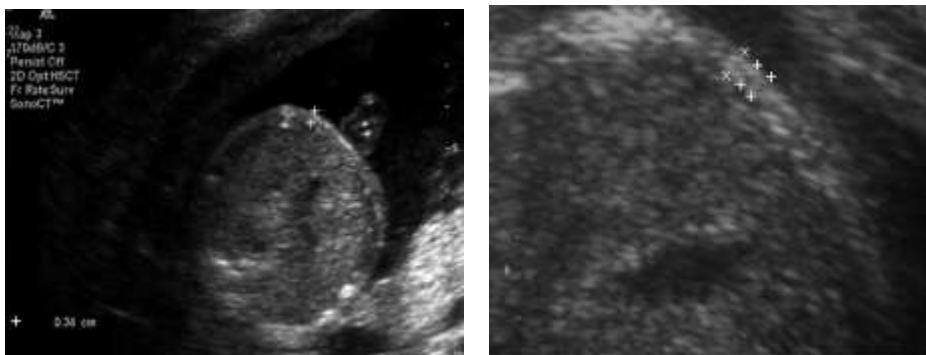
Figure 1 Axial ultrasound image of the abdomen showing measurement of the subcutaneous fat. (a) Standard view; (b) enlarged view.

7. The actual birth weight will be determined after delivery.

Outcomes:

- Primary outcome: Accuracy of FASTT in prediction of birth weight.
- Secondary outcome: Accuracy in prediction of low birth weight and macrosomia.

Ethics Aspects:

- The study protocol is in agreement with the Helsinki declaration of Ethical Medical Research. The Study protocol is to be approved by the Ethical committee of 0bstetrics and Gynecology department, Ain Shams University.
- All Participating women have to sign an informed written consent before being recruited in the study after through explanation of the procedure and purpose of the study.
- Any participating woman has the right to withdraw herself from the study at any phase without an adverse effect regarding the provided medical service.

Sample Size Justification

Raosoft program was used for sample size calculation. It was guided by the following data: Margin of error accepted 5%, needed confidence level 95%, population size (study population= 20000), expected response distribution =50%. The total sample size will be 400 pregnant women during this study according to the predetermined inclusion criteria.