THREE-DIMENSIONAL MEASUREMENT OF GESTATIONAL, YOLK SAC VOLUMES AND RETROCHORIONIC BLOOD FLOW STUDY AS PREDICTORS OF PREGNANCY OUTCOME IN THE FIRST TRIMESTER

Thesis

Submitted for the partial fulfillment of Master

Degree in Obstetrics and Gynecology

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2012

ACKNOWLEDGEMENT

First and foremost I feel always indebted to ***Allah,*** the most kind and the most merciful.

I would like to express my sincere gratitude to ***Prof. Dr. Soumaya Mohamed Hassan Abou Elew,*** Prof. of Obstetrics and Gynecology, Faculty of Medicine-Cairo University, for her sincere help, guidance, everlasting support, keen supervision and valuable instructions throughout this study.

I am deeply grateful to ***Dr. Hoda Mohamed Abd El Aal,***

Lecturer of Obstetrics and Gynecology, Faculty of Medicine-Cairo University, for offering me much of her time, constant encouragement and generous support throughout the whole work.

I am deeply indebted to ***all my family*** for the continuous support and help throughout the study.

ABSTRACT

Title: Three-dimensional measurement of gestational, yolk sac volumes and retrochorionic blood flow study as predictors of pregnancy outcome in the first trimester.

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Aim of the work: to determine the value of three-dimensional ultrasound measurement of the volumes of gestational, yolk sacs and retrochorionic blood flow study in the prediction of pregnancy outcome in the first trimester.

Patients and methods: This is a prospective study which was carried out at Kasr el-Eini hospital in the period between December 2009 and June 2011. The study included 110 pregnant women in their first trimester. They were subjected to three-dimensional ultrasonographic measurement of gestational, yolk sac volumes and retrochorionic blood flow study during the first trimester. Each patient was examined once and revised after twenty weeks'gestation for the occurrence of normal or abnormal pregnancy progression.

Results: The present study included 110 participants, they were divided into 2 groups of participants the first group included 50 participants (Normal-Control group), the second group included 60 participants with the same inclusion and exclusion criteria of the first group except for having history of two or more abortions in the first trimester. On Comparing data between the cases who continued pregnancy and those who did not in relation to the controls who continued the GSV showed statistically significant difference between the three groups, the YSV showed no statistically significant difference between the three groups. The RI of retrochorionic arteries showed statistically significant difference between the three groups.

Key Words: Three-dimensional ultrasound - Gestational sac volume - Yolk sac volume - Retrochorionic blood flow - Pregnancy outcome.

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ABBREVIATIONS AND ACRONYMS

- **2D US:** Two- dimensional ultrasound.
- **3D US:** Three- dimensional ultrasound.
- **3D-PDA:** three-dimensional power Doppler angiography.
- **3DXI:** Three- dimensional extended imaging.
- **4D US:** four- dimensional ultrasound.
- **AFP:** Alpha-fetoprotein**.**
- **ALARA:** as low as reasonably acceptable**.**
- **APS:** antiphospholipid syndrome
- **CRL:** Crown-rump length.
- **CT:** Computed Tomography**.**
- **DNA:** DeoxyriboNucleic Acid.
- **ECC:** Exocoelomic cavity**.**
- **FDA:** Food and Drug Administration.
- **GA:** gestational age.
- **GS:** Gestational sac.
- **GSV:** Gestational sac volume.
- **HCG:** Human chorionic gonadotropin.

- **Hcg mRNA:** Human Chorionic Gonadotropin Messenger Ribonucleic Acid.
- **ISPTA:** spatial peak-temporal average intensity.
- **IUGR:** intrauterine growth restriction.
- **M I:** mechanical index**.**
- **MMPs.** Matrix Metalloproteinases.
- **MRI:** Magnetic Resonance Imaging.
- **NT: N**uchal translucency.
- **PI:** Pulsatility index.
- **pO2:** Partial Pressure of Oxygen.
- **RA-RI:** Radial artery Resistance index.
- **RI:** Resistance index.
- **ROI:** region of interest.
- **SD:** Standard deviation**.**
- **Sono AVC:** Sonographic Automatic Volume Control**.**
- **SYS:** Secondary yolk sac.
- **T I:** Thermal index.
- **TAS:** Transabdominal sonar.

- **TVUS:** Transvaginal ultrasound.
- **UA-RI:** Uterine artery Resistance index.
- **US:** Ultrasound.
- **VEGFR-1:** Vascular endothelial growth factor-1.
- **VOCAL:** Virtual Organ Computer-aided AnaLysis.
- **XI VOCAL:** extended imaging virtual organ computer-aided analysis.
- **YS:** Yolk sac.
- **YSV:** Yolk sac volume.

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INTRODUCTION

Understanding the normal development of early pregnancy and observing this process ultrasonographically has allowed us to monitor effectively first-trimester pregnancy, and recognize early signs of abnormal outcome. Crown-rump length (CRL) has been found the most accurate method to determine gestational age (GA) in the first trimester, and in some cases to predict abnormal outcome as well. In addition, the size (diameter) of embryonic structures such as gestational sac (GS) and yolk sac (YS) was also found to have a good prognostic value for adverse outcome ***(Babinszki et al., 2001).***

Ultrasonography is an accurate method for evaluating early gestations, because it can readily demonstrate presence or absence of fetal heart motion, as well as the evaluation of the morphologic features of the gestational sac that may suggest non-viability such as disproportionate sac size, distorted sac shape or thin poorly echogenic decidual reaction. Clinical management depends on embryonic life. Therefore, reliable identification of non-viable gestations is important for determining which patient deserves rapid evacuation. Abnormal uteroplacental circulation has been involved in the pathogenesis of early pregnancy failure ***(Camejo et al., 2003).***

The emergence of three-dimensional (3D) ultrasound in obstetrics provided an opportunity to revisit previously abandoned or disregarded obstetric ultrasound parameters, particularly in early pregnancy. 3D

assessment of gestational sac volume in the first trimester has been found to be a sensitive indicator of pregnancy outcome, with a smaller than expected gestational sac volume being predictive of failing early pregnancy. It has not, however, proved useful in determining the outcome of expectant management or in predicting the success of medical treatment and appears to add little to the diagnostic or prognostic value of two-dimensional imaging ***(Jauniaux et al., 2005).***

Normal trophoblast invasion to the maternal decidua and decidual blood vessels is essential for successful placentation. In particular, dramatic changes in vascular structure occur in the maternal-fetal interface at placentation. Extravillous trophoblasts invade uterine spiral arteries, modifying their endothelial lining and media, and cause progressive dilatation of these vessels. The vascular remodeling in the maternal-fetal interface may reduce local arterial resistance and thereby increase uteroplacental blood flow. Impairment of this process is associated with pregnancy complications including spontaneous abortion, intrauterine growth restriction and pre-eclampsia ***(Tamura et al., 2008).***

The advent of color Doppler imaging in combination with high resolution transvaginal ultrasonography has extended the use of ultrasound imaging for the in-vivo functional evaluation of uteroplacental circulation in early pregnancy ***(Mitreski and Radeka, 2001).***