بسم الله الرحمن الرحيم

#####

تم رفع هذه الرسالة بواسطة / حسام الدين محمد مغربي

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات : لا يوجد

Prediction of morbidly adherent placenta using Two-dimensional versus Three-dimensional Ultrasound Using Crystal Vue®: Diagnostic Test Accuracy Study

Thesis

Submitted for partial fulfillment of Master Degree in Obstetrics and Gynecology

By

Manival Usama Mostafa Ibrahim

M.B., B.Ch. Cairo University (2012)

Under supervision of

Prof. Dr. Mohamed Hassan Nasr Eldeen

Professor of Obstetrics and Gynecology
Faculty of Medicine, Ain Shams University

Dr. Mohamed Hamed Salama

Assistant Professor of Obstetrics and Gynecology
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
2021

Acknowledgment

First and foremost, I feel always indebted to **ALLAH,**
the Most Kind and Most Merciful.

I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Mohamed Hassan Nasr Eldeen,** *Professor of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to **Dr. Mohamed Hamed Salama,** *Assistant Professor of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

Manival Usama

List of Contents

List of Abbreviations

Abb.	Full term
2D	Two-Dimensional
3D	Three-Dimensional
3DUS	3D ultrasound
4D	Four-dimensional
AC	Abdominal circumference
ACOG	American College of Obstetricians and Gynecologists
AIP	Abnormally invasive placenta
BMI	Body mass index
BPD	Biparietal diameter
BPMF	Basal plate myometrial fibers
CCT	Controlled cord traction
CDI	Colour Doppler imaging
CI	Confidence interval
CNS	Central nervous system
CS	Cesarean section
DA	Diagnostic accuracy
DR82	Dynamic range 82
EFW	Estimated fetal weight
EVT	Extravillous trophoblast
FIGO	The International Federation of Gynecology and Obstetrics
G58	Gain rate at 58
HC	Head circumference
HGF	Hepatocyte growth factor

List of Abbreviations Cont...

Abb.	Full term
IGF2	Insulin-like growth factor 2
ISUOG	International Society of Ultrasound in Obstetrics and Gynecology
LR	Diagnostic odd ratio
LR-	Negative likelihood ratio
LR+	Positive likelihood ratio
MAP	Morbidly adherent placenta
MMPs	Matrix metalloproteinases
MRI	Magnetic resonance imaging
MROP	Manual removal of placenta
NPV	Negative Predictive value
OR	Odds ratio
PAS	Placenta accreta spectrum
PH	Primary hysterectomy
PPV	Positive Predictive value
RCOG	Royal College of Obstetricians and Gynaecologists
RR	Relative risk
SMFM	Society for Maternal-Fetal Medicine
TGF-ß	Transforming growth factor-ß
TIMPs	Tissue inhibitors of metalloproteinases
TVUS	Transvaginal ultrasound
US	Ultrasonography
VEGF	Vascular endothelial growth factor
VRU	Volume rendering ultrasound
YI	Youden's index

List of Tables

List of Figures

List of Figures Cont...

PROTOCOL OF A THESIS FOR PARTIAL FULFILMENT OF MASTER DEGREE IN OBSTETRICS AND GYNECOLOGY

Title of study: Prediction of morbidly adherent placenta using Two-dimensional versus Three-dimensional Ultrasound Using Crystal Vue®: Diagnostic Test Accuracy Study

Postgraduate Student: Manival Usama Mostafa Ibrahim

Degree: M.B., B.Ch. Cairo University (2012)

DIRECTOR: Mohamed Hassan Nasr Eldeen
Academic Position: Professor.
Department: Obstetrics and gynecology.

Co-DIRECTOR: Mohamed Hamed Salama
Academic Position: Assistant professor.
Department: Obstetrics and Gynecology.

2019

1. INTRODUCTION/REVIEW

Placenta is an organ responsible for nutritive, respiratory, and excretory functions of the fetus during pregnancy *(Lebovitz et al., 2018)*.

The incidence of morbidly adherent placenta has increased dramatically over the last three decades, in concern with the increase in the caesarean section rate *(Bartels et al., 2018)*.

Previous cesarean delivery increases this risk to 3% for the first delivery, and to 40% and 67% for the third and fifth deliveries, respectively *(Cahill et al., 2018)*.

An abnormal placentation into the uterine wall could present a risk of maternal and fetal morbidity (morbidly adherent placenta, MAP) and mortality, so it should be identified and defined early on *(De Vita et al., 2019)*.

In abnormal implantation, placental delivery fails, which can result in severe postpartum hemorrhage with possible multiple organ failure and damage to the nearby organs such as bladder, bowel, and ureters *(Kocher et al., 2017)*.

In these cases, emergency hysterectomy is usually required. One-third to one-half of all emergency postpartum hysterectomies are performed as a result of adhesive placental disorders *(Bartels et al., 2018)*.

MAP is classified on the basis of depth of infiltration into the myometrium: in placenta accreta, there is direct contact between chorionic villi and myometrium without decidua basalis; in placenta increta, chorionic villi invade the myometrium without reaching the serous layer; in placenta percreta, villi invade through the myometrium to reach or extend beyond the serosa into the surrounding tissues *(Moser et al., 2018)*.

The risk of placental abnormalities increases in the presence of uterine scars due to cesarean delivery or gynecologic procedures such as curettage, myomectomy, and hysteroplasty (when placenta implants are on the scar area), and also in women with maternal age greater than 35 years and multiparity *(Cali et al., 2020)*.

The site of placental implantation is a risk factor as well. Placenta

previa is a pathologic condition in which the placenta is inserted in the lower uterine segment contributing to postpartum hemorrhage *(Fan et al., 2017)*.

Prenatal ultrasonography (US) represents the first-line method for diagnosing antepartum placental abnormalities, with high sensitivity and specificity rates reported at 85.7% and 88.6%, respectively *(Abd El-Gaber et al., 2017)*.

Second and third trimester gray-scale sonographic characteristics include loss of continuity of the uterine wall, multiple vascular lacunae (irregular vascular spaces) within placenta, giving ''Swiss cheese'' appearance adjacent to the placental implantation site, lack of a hypoechoic border (myometrial zone) between the placenta and the myometrium, bulging of the placental/myometrial site into the bladder, and increased vasculature evident on color Doppler sonography *(Zaidi et al., 2016)*.

When a placenta accreta occurs on the posterior or lateral walls of the uterus, it may be difficult to detect by ultrasound. Visualization of lacunae has the highest sensitivity in the diagnosis of PA, allowing identification in 78%-93% of cases after 15 weeks gestation, with a specificity of 78.6% *(Baughman et al., 2018)*.

The Three-dimensional ultrasound (Semi-Automated detection system):

In conventional two-dimensional ultrasound, the sonographer must manipulate accordingly to locate an appropriate plane for fitting measurements. The 2D ultrasound is also burdensome as sonographers must meet with patients directly to conduct a lengthy examination. Furthermore, the accuracy of diagnosis and construction of images mainly depend on the degree of the sonographer's experience and expertise *(hur et al., 2015)*.

To compensate for these weakness, semi-automated detection system, 3D ultrasound was made available to streamline the process of reconstructing the multiple views of the examined organ *(Thienphrapa et al., 2014)*.

Three-dimensional workflow refers to semi-automated identification of specific diagnostic image planes and measurements from a volume data set. Examples include the 3D LB (fetal long-bone) and 3D NT (nuchal translucency) features *(Meiburger et al., 2018).*

Clinical applications of this new technology include:

1. The Three-Dimensional Ultrasound Heart which is designed to simultaneously display nine standard fetal cardiac views by applying intelligent navigation technology to volume datasets of fetal heart.

2. 3D CNS which displays six me measurements (BPD, HC, OFD, Cerebellum, Posterior Fossa, Atria lateral ventricle) from three transverse views generated from a single volume of the fetal brain to enhance measurement reproducibility and streamline workflow

3. 3D Follicle which Identifies and measures multiple ovarian follicles for rapid assessment of follicular size and status during gynecology examinations. *(Meiburger et al., 2018)*

2. AIM/OBJECTIVES

The present study aims to evaluate the diagnostic accuracy of the transvaginal 2D ultrasound versus abdominal 3D Ultrasound using semi-automated detection system with Crystal Vue® software in order to predict Morbidly Adherent Placenta according to the scoring system of RCOG.

Research question:

Is the Semi-automated system in 3D Ultrasound superior to transvaginal 2D Ultrasound in the diagnosis of morbidly adherent placenta??

Study Hypothesis:

Three-Dimensional Ultrasound with Crystal Vue® software is superior to Two-dimensional Ultrasound in diagnosis of morbidly adherent placenta

3. METHODOLOGY

Patients and Methods/ Subjects and Methods/ Material and Methods

- *Type of Study:* Diagnostic Test Accuracy Study using Cross sectional study.

- *Study Setting:* The study will be conducted at Special care center of fetus, Ain Shams University Maternity Hospital, Cairo, Egypt

- *Study Period:* The study will be conducted from June 2019 till June 2020.

- *Study Population:* The study will include 185 patients diagnosed with morbidly adherent placenta

Inclusion Criteria:

- ✓ Patient aged 18-42 (child bearing period)

- ✓ Pregnant women above 28 weeks gestation diagnosed as adherent placenta by Standard 2D ultrasound examination.

- ✓ Patients who have done one or more than one caesarean section or previous hystrotomy.

- ✓ History of adherent placenta

- ✓ Placenta previa with its lower edge covering the scar of previous CS.

Exclusion Criteria:

- Patient who won't deliver at our hospital

- Refusal to give a consent

- Pregnancy with multiple gestations (placenta will not be accurately visualized)

- Chorioamnionitis (due to abnormal decidualization)

- Placental abnormalities (as accessory lobe, villamentous) (abnormal implantation couldn't be excluded)

-Study Procedures and Intervention:

**   *Initial approach:* patients fulfilling the inclusion and exclusion criteria will be approached in the antenatal clinic or the special care unit of the fetus where the study protocol and procedure will be explained in Arabic (form 2).**

**   All caesarean sections and procedures will be done by supervisors and experts.**

Upon agreement to participate in the study the patient will be asked to sign informed consent

 Patient history will be reviewed

The study will include patients who will be selected from the outpatient and inpatient obstetric Ain Shams maternity hospital.

Ultrasound imaging:

    In the special care unit of the fetus the patient will be subjected to

1. **2D ultrasound:** the safety of 2D ultrasound has been established in patients who undergo transvaginal examination *(Fatahi Asl et al., 2020).*