Prediction of Pregnancy Outcome in ICSI Cycles Using Endometrial and Total Follicular Volume in the Day of HCG Trigger

Thesis

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By

Gehan Mahmoud Abdelmoty

MB.B.CH, Ain Shams University, 2005

Obstetrics and Gynecology Resident

at Bahteem Central Hospital

Ministry of Health and Population

Supervised by

Prof.

Yasser Mohamed Ali Abo-Talib

Professor of Obstetrics and Gynecology

Faculty of Medicine - Ain Shams University

Assistant Prof.

Mohamed Abdel-Hameed Abdel-Hafeez

Assistant Professor of Obstetrics and Gynecology

Faculty of Medicine - Ain Shams University

Dr.

Radwa Mansour Mohamed

Lecturer in obstetrics and gynecology

Faculty of Medicine - Ain Shams University

Faculty of Medicine – Ain Shams University

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Gehan mahmoud

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List of Abbreviations

Abb.	Full term
2 D	*Two dimentional*
3D	*Three dimentional*
ACOG	*American College of Obstetricians and Gynecologists*
ART	*Assisted reproductive Techniques*
ASRM	*American Society for Reproductive Medicine*
AUC	*area under ROC curve*
AVC	*Automated volume calculation*
COH	*Controlled ovarion hyperstimulation*
E2	*Estradiol*
ESHRE	*European society for human reproduction and embryology*
ET	*Embryo transfer*
EV	*Endometrial volume*
FI	*Flow index*
FSH	*Follicular stimulating hormone*
FV	*Follicular volume*
FV	*Follivular volume*
GnRH	*Gonadotrophin releasing hormone*
GV	*Germinal vesicle*
HCG	*Human chorionic gonadotrophin*
HSG	*Hystrosalpingography*
ICSI	*Intracytoplasmic sperm inection*
IUI	*Intrauterine insemination*
IVF	*In vitro fertilization*
IVM	*In vitro maturation*
LH	*Lutenizing hormone*
LPD	*Luteal phase defect*
MI	*Metaphase I*

List of Abbreviations (Cont...)

Abb.	Full term
MII	*Metaphase II*
MRI	*Magnatic resonance iimaging*
NF	*Number of follicles*
NPV	*Negative predictive value*
OHSS	*Ovarian hyperstimulation syndrome*
OV	*Ovarian volume*
PCOS	*Polycystic ovary syndrome*
PD	*Power Doppler*
PDUS	*Power Doppler ultrasound*
PPV	*Positive predictive value*
RI	*Resistance index*
ROC	*Receiver-operating characteristic*
SD	*Standard deviation*
TESE	*Testicular sperm extraction*
TVUS	*Tranvaginal ultrasound*
US	*Ultrasound*
VI	*Vascularization index*
VOCAL	*Virtual Organ Computer-Aided Analysis*
WHO	*World Health Organization*

Abstract

This study aimed at testing whether 3D U/S measurement of follicular volume, ovarian volume and endometrial volume can predict pregnancy in ICSI cases. The study recruited 136 infertile women attending assisted reproduction unit, and were evaluated by 3D US for total follicular volume and endometrial volume in the day of HCG trigger after long protocol for controlled ovarian hyperstimulation. Embryo graded according to predefined criteria. Embryo transfer was done with ultrasound-guided technique about 3-5 days after oocytes retrieval and one to three embryos will be transferred.- End point: To diagnose pregnancy, by ultrasound finding of gestational sac. Main Outcome Measure(s): Occurrence of clinical pregnancy by the presence of intrauterine gestational sac diagnosed by ultrasound scan. Secondary outcome measures (s): Biochemical pregnancy rate, Number of mature oocytes retrieved, Embryo number and quality.

Keywords: Assisted reproductive Techniques - Automated volume calculation - Human chorionic gonadotrophin - Intrauterine insemination

INTRODUCTION

Infertility may describe a woman who is unable to conceive as well as being unable to carry a pregnancy to full term. There are many biological and other causes of infertility, including some that medical intervention can treat ***(Makar and Toth, 2002).***

Estimates from 1997 suggest that worldwide "between three and seven percent of all couples or women have an unresolved problem of infertility. Many more couples, however, experience involuntary childlessness for at least one year: estimates range from 12% to 28%" ***(Himmel et al., 1997).*** Twenty to thirty percent of infertility cases are due to male infertility, Twenty to thirty five percent are due to female infertility, and 25-40% are due to combined problems in both parts. In 10-20% of cases, no cause is found ***(ESHRE, 2014)***. The most common cause of female infertility is ovulatory problems which generally manifest themselves by sparse or absent menstrual periods ***(National Health Service, 2014).*** Male infertility is most commonly due to deficiencies in the semen, and semen quality is used as a surrogate measure of male fecundity.

In vitro fertilization (IVF) refers to a procedure designed to overcome infertility and produce a pregnancy as a direct result of the intervention. In general, the ovaries are stimulated by a combination of fertility medications and then one or more

oocyte(s) are aspirated from ovarian follicles. These are fertilized in the laboratory ("in vitro"), after which, one or more embryo(s) are transferred into the uterine cavity. These steps occur over about a two-week interval of time, which is called an IVF cycle ***(Paulson et al., 2016).***

To date, bi-dimensional Ultrasound (2D US) technique has been used to monitor the ovarian response and to study the growing follicles in most of the IVF cycles performed worldwide ***(Revelli et al., 2014).***

US diagnosis of follicle maturity and favorable pregnancy prognosis remain challenges for the gynecologist ***(Coulam et al., 1999)***. Although follicle maturity is routinely assessed using 2D PD(power Doppler) US, some patients undergoing induced ovulation cycles still cannot achieve pregnancy despite having adequate sonographically controlled cycles ***(Engels et al., 2011).***

In the 2D-transvaginal scanning, the two longest diameters of each growing follicle are measured, and the mean follicle diameter is calculated. In the last years, also three-dimensional (3D) ultrasound has been tested as a tool to monitor COH (controlled ovarian hyperstimulation) during IVF, and the first data are now available ***(Revelli et al., 2014).***

Currently 3D-US may be performed by manual measurement of follicle circumference through Virtual Organ

Computer-Aided Analysis (VOCAL) or by an automated US application, the Sonography-based Automated Volume Calculation (SonoAVC) ***(Ata and Tulandi, 2011).***

3D US with the VOCAL image processing software allows an accurate calculation with high reproducibility of the volume of any pelvic organ ***(Merce et al., 2005).***

Several reports using 3D US and 3D PDUS to study the ovarian reserve, and the response to ovarian stimulation, have been published with the aim of identifying US markers of ovarian response, and assessing the quality of follicles, oocytes, and embryos. Some studies suggest a relationship between increased follicular and subfollicular vascularization, measured by 2D and 3D US, and a higher production of mature oocytes with higher fertilization rates in intrauterine insemination (IUI) ***(Bhal et al., 1999).***

Moreover, follicular volume measured by 3D US may be an independent factor for IVF and intracytoplasmic sperm injection outcome ***(Schild et al., 2001).***

Conception in IVF programs requires good quality embryos as well as a receptive endometrium ***(Friedler et al., 1996)***. Despite the marked advances in assisted reproductive techniques, the implantation rate per embryo has remained very low at 20 % ***(Pope et al., 2004).*** While the assessment of embryoquality and proper grading is done in the lab before

transfer, the assessment of endometrial receptivity is more difficult. Transvaginal ultrasonography is an ideal non-invasive method, but lacks specificity ***(Sundstrom, 1998)***.

The use of 3 D ultrasonography to examine the uterine cavity in detail and reconstruct the images of the uterus surpasses the diagnostic potential of 2D ultrasound ***(Lev-Toaff et al., 2001)***. Several studies have confirmed a high degree of reproducibility and accuracy of endometrial volume estimation using 3D ultrasound ***(Yaman et al., 2000).***

Revelli et al., in 2014 conducted a critical review of 2D and 3D ultrasound techniques to monitor follicle growth, to answer a question, do they help improving IVF outcome? And they concluded that the study of follicular size by 2D-US is of limited usefulness in helping in the identification of follicles containing the best oocytes and in choosing the best moment to trigger ovulation. Possibly the value of US in this area will be improved by large prospective studies in which automated 3D-US will be used ***(Revelli et al., 2014).***

Also ***Singh et al.,*** in 2015 conducted a prospective study to compare the predictive value of manual 2D follicular monitoring with that of sonography-based automated volume calculation (SonoAVC) in routine follicular tracking in IVF. Their results showed that, 3D SonoAVC could be a useful adjunct for follicular monitoring, with a significant reduction in time and a good correlation with manual counts. However, they advised for further studies with larger sample ***(Singh et al., 2015)***.