

3D Ultrasound Assessment of Endometrial Junctional Zone anatomy as a Predictor of the Outcome of ICSI cycles

Thesis

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List of ABBREVIATIONS

AMH	Anti Mullerian hormone
ART	Assisted reproductive techniques
AUC	Area Under the Curve
BMI	Body mass index
CI	Confidence interval
EMJ	Endometrial-myometrial junction
E2	Estradiol
ET	Embryo transfer
FSH	Follicular Stimulating hormone
GnRH	Gonadotropin releasing hormone
HCG	Human chrionic gonadotropin
HMG	Human menopausal gonadotropin
ICSI	Intracytoplasmic sperm injection
IVF	In vitro fertilization
JZ	Junctional zone
LH	Luteinizing hormone
MRI	Magnetic resonance imaging
OPU	Ovum pickup
OR	Oocytes retrieval
OHSS	Ovarian hyperstimulation syndrome
PCOS	Polycyctic ovarian syndrome
PR	Pregnancy rate
ROC	Receiver operator characteristic
SC	Subcutaneous

SD	Standard deviation
TVS	Transvaginal sonography
U/S	Ultrasound
VCI	Volume Contrast Imaging
3D	Three-dimensional
2D	Two-dimensional

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Abstract

Objective :

To identify whether or not the Junctional Zone thickness should be considered as a predictor of the outcome of ICSI cycles .

Design :

Cohort Prospective study.

Setting :

In Vitro Fertilization Unit at Kasr Al Ainy, Faculty of Medicine, Cairo University.

Patients :

50 patients aged 18-35 years old, diagnosed as primary infertility due to the following causes of infertility; (Pelvic Inflammatory disease, Anovulation , tubal infertility, unexplained infertility, combined infertility or due to male factor) . All The patients were scheduled for ICSI cycles . They underwent a 3D Transvaginal Ultrasound to measure the Junctional Zone thickness twice to determine the rate of implantation .

Intervention(s) :

All the patients were subjected to 3D Transvaginal ultrasound to measure the thickness of the Junctional zone twice first time when they became downregulated and then followed up at day of OPU . All the patients underwent ICSI cycles .

Main Outcome Measure(s) :

Junctional zone thickness and the pregnancy rate.

Results :

The junctional zone thickness was relatively thinner in patients who became pregnant than in non-pregnant patients. The average junctional zone value of ≤ 0.32 cm was the cutoff point as determined by the results.

Conclusion :

Junctional zone thickness may play a role as a routine tool for investigating infertile patients, undergoing ICSI cycles .

Key Words :

Junctional zone , Uterus , ICSI , 3D Ultrasound .

INTRODUCTION

Introduction

The myometrium exhibits an inner one third representing the junctional zone (JZ) , which consists of two subdivisions, an inner compact portion and an outer transitional portion that blends into the myometrium proper.

The JZ or endometrial–myometrial junction (EMJ), is the transitional zone, sandwiched between the endometrium and the outer myometrium. Unlike most human tissues with a mucosa, the endometrium does not contain a submucosal layer. This layer usually exists to protect against mucosal invasion into adjacent tissue (*Jurkovic D. et al., 2009*) .

The JZ is a distinct, hormone-dependent uterine compartment at the endomyometrial interface that was visualized more than 20 years ago by magnetic resonance imaging (MRI) (*Brosens I. et al., 2006*) .

It has been confirmed recently that what is defined in ultrasound terms as the subendometrial halo represents the same histological structure (*Tetlow et al., 1997*) .

In recent years, the Endomyometrial JZ has emerged as a specialized zone, which governs many critical reproductive functions (*Brosens I et al., 2010*) .

Also, some authors suggested that the JZ and its alterations like adenomyosis might compromise embryo implantation and further fertility outcome (*Fusi L et al., 2006*) .

Transvaginal ultrasound studies have shown that propagated myometrial contractions in the non-pregnant uterus originate only from the JZ and that the frequency and orientation of these contraction waves are dependent on the phase of the menstrual cycle (*Brosens JJ et al., 1998*) .

There is evidence that this pattern of contractions facilitates sperm transport , aids implantation of the developing blastocyst, improves the supply of oxygen and nutrients to the deciduas and, in addition, contributes to menstrual shedding (*Fusi L et al., 2006*)

The 3D technology has made it possible to accurately assess and grade changes in the JZ architecture such as thickening, disruption and protrusion of the endometrium into the inner myometrium.

On the coronal view by 3D ultrasound the JZ appears as a hypoechoic zone around the endometrium . Using volume contrast imaging (VCI) modality with 2–4 mm slices it could be viewed clearly in all planes of the multiplanar view and the JZ thickness is measured as the distance from the basal endometrium to the internal layer of the outer myometrium (*Exacoustos et al., 2011*)

Endometrial receptivity is defined as the period during which the endometrial epithelium acquires functional, but transient, ovarian steroid-dependent status supportive to blastocyst acceptance and implantation (*Makker et al., 2006*) .

A blastocyst can implant into the endometrium only during a short period of time called the window of implantation . It is believed that it lasts about 48 hours, beginning 6–10 days after the LH surge in a spontaneous cycle (*Aghajanova L et al., 2008*)

Different ultrasound parameters have been used to assess endometrial receptivity during ART treatment, including endometrial thickness, endometrial pattern, endometrial volume, Doppler of uterine arteries and endometrial blood flow. However, conflicting results have been reported with regard to their role in the prediction of pregnancy in ART treatment (*J Turkish, 2012*).

Successful implantation requires a receptive endometrium, a normal and functional embryo at the blastocyst developmental stage and a synchronized dialogue between maternal and embryonic tissues (*Simon et al., 2000*).

The probability of success with IVF is related to several factors, many of which are unfortunately not known until the treatment cycle is well underway (response to stimulation) or even nearing completion (number and quality of embryos). Before an IVF cycle begins, the primary prognostic indicators are maternal age, ovarian reserve, Duration and Type of subfertility, Basal FSH, Body mass index (BMI) and past reproductive performance (*Speroff L et al., 2011*).

Women with top chances of IVF success have per-cycle success rates of 40% or higher, while the majority of women have per-cycle success rates of 20-35% (*Sunderam S et al., 2006*).

The purpose of this study is to help figure out whether the junctional zone should be considered as a prognostic factor for determination of Implantation rate in ICSI cycles. The Junctional Zone is measured to the right and left sides of the uterus and at the fundus of the uterus and an average diameter is documented using 3D Transvaginal U/S.