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ARTICLE

Endometrial thickness as a predictor of pregnancy outcomes in 10787 fresh IVF–ICSI cycles

Xi Yuan [a,b,c], Sotirios H Saravelos [b], Qiong Wang [a], Yanwen Xu [a], Tin-Chiu Li [b,*], Canquan Zhou [a,**]

[a] *Reproductive Medicine Centre, Department of Obstetric and Gynecology, The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, China;* [b] *Department of Obstetrics and Gynecology, Prince of Wales Hospital, The Chinese University of Hong Kong, Hong Kong;* [c] *MOH Holdings Pte Ltd (MOHH), Singapore*

* Corresponding author. *E-mail address:* tinchiu.li@cuhk.edu.hk (T-C Li).** Corresponding author. *E-mail address:* zhoucanquan@hotmail.com (C Zhou).

Dr. Xi Yuan obtained her MBBS from Sun Yat-sen University in Guangzhou, China in 2013, and later obtained her MD in 2015. She completed her research under the direction of Professor Canquan Zhou in the First Affiliated Hospital of Sun Yat-sen University, and under the direction of Professor TC Li at both the Jessop Wing Hospital, Sheffield, UK, and the Prince of Wales Hospital, The Chinese University of Hong Kong, where the research project was completed.

Abstract This retrospective study assessed the predictive value of endometrial thickness (EMT) on HCG administration day for the clinical outcome of fresh IVF and intracytoplasmic sperm injection (ICSI) cycles. A total of 8690 consecutive women undergoing 10,787 cycles over a 5-year period were included. The 5th, 50th and 95th centiles for EMT were determined as 8, 11 and 15 mm, respectively. Group analysis according to these centiles (Group 1: < 8 mm; Group 2: ≥ 8 and ≤11 mm; Group 3: > 11 and ≤15 mm; Group 4: > 15 mm) demonstrated significant differences ($P < 0.001$) in clinical pregnancy rates (23.0%, 37.2%, 46.2% and 53.3%, respectively), live birth rates per clinical pregnancy (63.3%, 72.0%, 78.1% and 80.3%, respectively), spontaneous abortion rates (26.7%, 23.8%, 19.9% and 17.5%, respectively), and ectopic pregnancy rates (10.0%, 4.3%, 2.1% and 2.2%, respectively). Logistic regression analyses showed EMT as one of the independent variables predictive of clinical pregnancy (OR = 1.097; $P < 0.001$), live birth (OR = 1.078; $P < 0.001$), spontaneous abortion (OR = 0.948; $P < 0.001$), and ectopic pregnancy (OR = 0.851; $P < 0.001$). Future research should aim to understand the underlying mechanisms relating EMT to conception, ectopic implantation and spontaneous abortion.

KEYWORDS: clinical outcome, endometrial thickness, endometrium, IVF–ICSI

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Introduction

Endometrial assessment has become part of standard monitoring during IVF and intracytoplasmic sperm injection (ICSI) with embryo transfer treatment. The endometrial characteristics, including endometrial pattern, endometrial blood flow, and endometrial thickness (EMT) have been regarded as prognostic factors of IVF–ICSI treatment (De Geyter et al., 2000; Järvelä et al., 2005; Wang et al., 2010). A solid and significant association between these parameters and IVF–ICSI outcome, however, has yet to be found, and controversy in their value still remains ever since the first reports (Alcázar, 2006; Gonen et al., 1989; Ng et al., 2006; Rabinowitz et al., 1986; Schild et al., 2001).

Transvaginal ultrasonography (TVU) is often used to measure EMT on the day of HCG administration as the maximal echogenic distance between the junction of the endometrium and myometrium in the mid-sagittal plane. It has been widely suggested that a thin endometrium is associated with lower IVF–ICSI pregnancy rates, but a consensus is still lacking on what the precise definition of thin endometrium is (Senturk and Erel, 2008), with cut-off values of EMT varying from 7–9 mm in earlier studies (Kasius et al., 2014).

A recent meta-analysis including 22 studies with a total of 10724 IVF–ICSI treatment cycles suggested that EMT has a limited capacity to identify pregnancy rates after IVF–ICSI (Kasius et al., 2014); the frequently reported cut-off of 7 mm was also considered to have a limited prognostic value for clinical pregnancy. Some of the limitations of this meta-analysis, however, can be acknowledged, including heterogeneity of participants included in various studies; lack of uniform definition of thin endometrium and its cut-off value; and observer variability regarding EMT measurement. In addition, the authors also considered that insufficient data were avaialble to conduct a meta-analysis on the rates of spontaneous abortion, ectopic pregnancy and live birth, which are also of significant clinical interest.

In this study, 10,787 fresh IVF–ICSI cycles were analysed from a single tertiary centre, with the aim of identifying epidemiological cut-off values for EMT, and assessing the predictive value of EMT for clinical outcome, namely intrauterine pregnancy, ectopic pregnancy, spontaneous abortion and live birth.

Materials and methods

Patients

A total of 8690 women undergoing a total of 10,787 fresh IVF–ICSI treatment cycles conducted between 1 January 2009 and 30 September 2013 were included in the study at the Reproductive Medical Center, Department of Obstetrics and Gynecology, the First Affiliated Hospital of Sun Yat-sen University, Guangzhou, China. In our centre, TVU was carried out routinely on the day of HCG administration.

Fresh IVF–ICSI treatment cycles and embryo transfers within the study period were included, regardless of diagnosis, reproductive history or insemination method. Cycles using donor oocytes, cryopreserved embryos or suspect endometrial abnormalities were excluded. The cause of infertility was categorized as tubal factor, male factor, endometriosis, preimplantation genetic diagnosis (PGD) for thalassemia of both partners, PGD for other monogenic disorders, other or multiple factors (including anovulation and polycystic ovary syndrome) and unexplained. Ovarian stimulation, oocyte retrieval, semen collection and processing, ICSI, PGD and embryo transfer procedures were carried out as previously described (Ding et al., 2014; Khoudja et al., 2013; Shen et al., 2011).

This was a retrospective study of routinely collected clinical data, and therefore did not require prospective ethics approval according to our institutional ethics policy.

Data collection

Patient demographics and characteristics were collected, including maternal and paternal age, height, weight, body mass index, duration of infertility, number of previous treated IVF–ICSI cycles, and basal levels of sex steroid hormones. Serum levels of FSH, LH, oestradiol, progesterone, testosterone and prolactin were measured with particle enzyme immunoassay (Abbott Axsym System, USA). The parameters related to the ovarian stimulation, and IVF–ICSI cycle, included serum level of FSH, LH, oestradiol and progesterone on the day of HCG administration, the EMT and endometrial pattern on day of HCG administration, number of retrieved oocytes and number of transferred embryos. The outcomes measured were clinical pregnancy rate per embryo transfer cycle, live birth rate per embryo transfer cycle, live birth rate per pregnancy, ectopic pregnancy rate per pregnancy and spontaneous abortion rate per pregnancy.

Transvaginal ultrasonography

All the TVU assessments were carriedout by subspecialist clinicians using the same standardized protocols on the same ultrasound machines in our department (ALOKA Color Ultrasound ProSound SSD-3500SV, Hitachi Aloka Medical America Inc., USA). Endometrial thickness and endometrial pattern were measured in the mid-sagittal plane of the uterine body on the day of HCG administration. The maximal thickness from one interface of the endometrial–myometrial junction to the other was measured.

Endometrial pattern was classified as type A (a triple-line pattern consisting of a central hyperechoic line surrounded by two hypoechoic layers); type B (an intermediate isoechogenic pattern with the same reflectivity as the surrounding myometrium and a poorly defined central echogenic line); or type C (homogenous, hyperechogenic endometrium).

All cycles were divided into four groups (group 1 to 4) depending on EMT, using the cut-off by the 5th (8 mm), 50th (11 mm), and 95th (15 mm) percentile of the whole population distribution: group 1 (<8 mm); group 2 (≥8 mm and ≤11 mm); group 3 (>11 mm and ≤15 mm); group 4 (>15 mm).

Pregnancy

Clinical pregnancy was defined as one in which a positive pregnancy was accompanied later by ultrasonographic evidence

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