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Endometrial pattern, thickness and growth in predicting pregnancy outcome following 3319 IVF cycle

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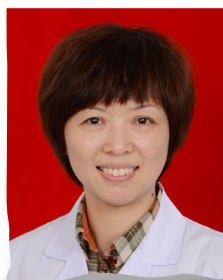
Yanping Li, MD, is a professor and doctoral supervisor of Central South University, Changsha, China and the Director of Reproductive Medicine Center, Department of Obstetrics and Gynecology, Xiangya Hospital. She performs more than 1000 IVF cycles per year and the clinical pregnancy rate is almost 50%. She conducts clinical work on infertility, IVF, preimplantation genetic diagnosis, intrauterine insemination and microsurgery, and research on reproductive endocrinology, poor ovarian response, thin endometria and embryonic stem cells.

Abstract   A retrospective study of 3319 women was conducted to assess predictive ability of endometrial characteristics for outcomes of IVF and embryo transfer. Endometrial thickness, growth and pattern were assessed at two time points (day 3 of gonadotrophin stimulation and day of HCG administration). Endometrial patterns were classified as pattern A: triple-line pattern comprising a central hyperechoic line surrounded by two hypoechoic layers; pattern B: an intermediate isoechogenic pattern with the same reflectivity as the surrounding myometrium and poorly defined central echogenic line; and pattern C: homogenous, hyperechogenic endometrium. The endometrium of pregnant women was thinner on day 3 of stimulation, thicker on the day of HCG administration, and showed greater growth in thickness compared with non-pregnant women. Clinical pregnancy rates differed according to endometrial pattern on the day of HCG administration (55.2%, 50.9% and 37.4% for patterns A, B and C, respectively). A positive linear relationship was found between endometrial thickness on the day of HCG administration and clinical pregnancy rate. Endometrial thickness, change and pattern were independent factors affecting outcome. Receiver operator characteristic curves showed that endometrial pattern, thickness and changes were not good predictors of clinical pregnancy. Discriminant analysis indicated that 58.7% of original grouped cases were correctly classified. Although endometrium with triple-line or increased thickness may favour pregnancy, combined endometrial characteristics do not predict outcomes.
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KEYWORDS: endometrial growth, endometrial pattern, endometrial thickness, pregnancy rate, transvaginal ultrasound

Introduction

Assisted reproductive technology has been commonly used in infertility treatment over the past 3 decades. In addition to embryo quality, the receptivity of the endometrium plays an important role in clinical outcome. Sonography is a non-invasive and simple method that has been used to evaluate endometrial receptivity. Several sonographic parameters have been evaluated. These include endometrial thickness, endometrial pattern, endometrial volume and endometrial and subendometrial blood flow (Basir et al., 2002; Dickey et al., 1992; Fanchin, 2001; Wang et al., 2010; Yuval et al., 1999).

Endometrial thickness and pattern have been evaluated as possible predictors of pregnancy in multiple studies, with conflicting results. Some investigators have reported significant correlations between pregnancy rate, endometrial thickness, pattern, or both (Al-Ghamdi et al., 2008; Chen et al., 2010; Noyes et al., 1995; Richter et al., 2007; Rinaldi et al., 1996), whereas others have not shown such a relationship (Basir et al., 2002; De Geyter et al., 2000; Dietterich et al., 2002; Rashidi et al., 2004). Only a few studies (Gonen and Casper, 1990; Gonen et al., 1989; McWilliams and Frattarelli, 2007); however, have evaluated the change in endometrial thickness occurring during IVF stimulation, and these studies reached different conclusions with small samples. This study was designed to assess the relationship between endometrial features (endometrial pattern and thickness and endometrium growth) and clinical outcome based on 3319 IVF stimulation cycles.

Materials and methods

Patient recruitment and counselling

The study was reviewed and approved by the Institutional Review Board and the Ethics Committee of Xiangya Hospital, Changsha, China (IRB reference number 201212047, dated 27 August, 2011). The study was conducted in accordance with the Declaration of Helsinki, as revised in 1983. We conducted a retrospective cohort study of 3319 consecutive infertile women. Briefly, the women underwent fresh IVF-ET between January 2009 and May 2011 at the Reproductive Medicine Centre of Xiangya hospital, Central South University (Changsha, China). Before undergoing IVF, patients were examined with ultrasonography more than once at the different stages of their menstrual cycles. If any subtle cavity abnormalities were found, those women were recommended to undergo further examination or treatment with hysteroscopy or saline sonohysterogram. Exclusion criteria included presence of known endometrial polyp, uterine anomaly, and insemination method other than IVF, cycles using donor oocytes or cryopreserved embryos. Patients underwent no therapeutic intervention other than routine procedures.

Ovulation induction and IVF–embryo transfer procedures

The choice of stimulation protocol was individualized on the basis of the patient's age, cause of infertility, ovarian response and co-existing medical conditions. Ovarian stimulation was initiated when the serum oestradiol concentration level was ≤50 pg/ml, and the largest follicle diameter was <10 mm without ovarian cysts. Urofollitiopin injection (HMG; LiZhu, China), human menopausal gonadotrophin, or both, were used to achieve ovarian stimulation. The initial dosage of gonadotrophin ranged from 150 to 450 IU, depending on the basal FSH level, antral follicular count and maternal age. When at least two follicles were 18 mm or wider in diameter, 10,000 IU of HCG (HCG; Profasi; Serono, Italy) was administered. Oocyte retrieval was carried out 36 h after the administration of HCG, and was followed by conventional IVF. Up to three high-quality embryos were transferred 72 h after oocyte collection according to the centre's standard practice. When available, surplus good-quality embryos were cryopreserved. The luteal phase was supported using 80 mg progesterone in oil (Progesterone; Tongyong, Shanghai, China) intramuscular injection daily lasting 75 days. Clinical pregnancy was defined as identification of a gestational sac 4–5 weeks after embryo transfer.

Ultrasound measurement

Endometrial features assessed included endometrial thickness and pattern on day 3 of gonadotrophin stimulation and on the day of HCG administration, as well as the change in endometrial thickness from day 3 to day of HCG administration. All were measured by transvaginal 8 MHz ultrasonography with Doppler ultrasound (Mindray DC-6 Expert; Shenzhen, China).

Endometrial thickness was measured in a median longitudinal plane of the uterus as the maximum distance between the endometrial–myometrial interface of the anterior to the posterior wall of the uterus. Endometrial pattern was classified as pattern A (a triple-line pattern consisting of a central hyperechoic line surrounded by two hypoechoic layers), pattern B (an intermediate isoechogenic pattern with the same reflectivity as the surrounding myometrium and a poorly defined central echogenic line), and pattern C (homogenous, hyperechogenic endometrium).

Statistical analysis

Continuous data were expressed as mean ± SD values or as median and range, according to the distribution, and were analysed for differences using the Student's t-test. Categorical data were presented as numbers, and chi-squared test was used for statistical comparison of percentages. Binary logistic regression analysis was also carried out, and the receiver operating characteristic (ROC) curve was applied to determine the predictive value of endometrial parameters. Discriminant analysis was used to evaluate the predictive ability of all of the endometrial parameters combined. The significance level for all analyses was $P < 0.05$. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA).

Results

A total of 3319 IVF cycles (3319 women) were included in the study. The clinical pregnancy rate, defined as identification