

Discriminant analysis forecasting model of first trimester pregnancy outcomes developed by following 9,963 infertile patients after in vitro fertilization

Yan Yi, M.D.,^a Xihong Li, Ph.D., M.D.,^b Yan Ouyang, M.D.,^a Ge Lin, Ph.D., M.D.,^{a,b} Guangxiu Lu, Ph.D., M.D.,^{a,b} and Fei Gong, Ph.D., M.D.^{a,b}

^a Institute of Reproductive and Stem Cell Engineering, Central South University; and ^b Reproductive and Genetic Hospital of CITIC-Xiangya, Changsha city, Hunan, People's Republic of China

Objective: To investigate a forecasting method developed to predict first trimester pregnancy outcomes using the first routine ultrasound scan for early pregnancy on days 27–29 after ET and to determine whether to perform a repeated scan several days later based on this forecasting method.

Design: Prospective analysis.

Setting: Infertile patients at an assisted reproductive technology center.

Patient(s): A total of 9,963 patients with an early singleton pregnancy after in vitro fertilization (IVF)-ET.

Intervention(s): None.

Main Outcome Measure(s): Ongoing pregnancy >12 weeks of gestation.

Result(s): The classification score of ongoing pregnancy was equal to $(1.57 \times \text{Maternal age}) + (1.01 \times \text{Mean sac diameter}) + (-0.19 \times \text{Crown-rump length}) + 25.15$ (if cardiac activity is present) $+ 1.30$ (if intrauterine hematomas are present) $- 47.35$. The classification score of early pregnancy loss was equal to $(1.66 \times \text{Maternal age}) + (0.84 \times \text{Mean sac diameter}) + (-0.38 \times \text{Crown-rump length}) + 8.69$ (if cardiac activity is present) $+ 1.60$ (if intrauterine hematomas are present) $- 34.77$. In verification samples, 94.44% of cases were correctly classified using these forecasting models.

Conclusion(s): The discriminant forecasting models are accurate in predicting first trimester pregnancy outcomes based on the first scan for early pregnancy after ET. When the predictive result is ongoing pregnancy, a second scan can be postponed until 11–14 weeks if no symptoms of abdominal pain or vaginal bleeding are present. When the predictive results suggest early pregnancy loss, repeated scans are imperative to avoid a misdiagnosis before evacuating the uterus. (Fertil Steril® 2016;105:1261–5. ©2016 by American Society for Reproductive Medicine.)

Key Words: Discriminate analysis, forecasting model, early pregnancy loss, in vitro fertilization-embryo transfer, transvaginal ultrasound

Discuss: You can discuss this article with its authors and with other ASRM members at <http://fertstertforum.com/yiy-prediction-pregnancy-outcome-ivf/>



Use your smartphone to scan this QR code and connect to the discussion forum for this article now.*

* Download a free QR code scanner by searching for "QR scanner" in your smartphone's app store or app marketplace.

For women who conceive by in vitro fertilization (IVF)-ET, the first routine pelvic ultrasound for early pregnancy is commonly performed on day 28 after ET in most assisted reproduction centers in China to determine the location and viability of the embryo. For an embryo of

unknown location or an ectopic pregnancy (EP), there are evidence-based guidelines for subsequent medical treatment, and the morbidity and mortality of these situations are markedly reduced by early screening (1–3). For a pregnancy of uncertain viability or for a currently viable pregnancy, an accurate method to predict the possibility of early miscarriage would be helpful for determining whether to make an arrangement for a subsequent ultrasound scan several

Received November 3, 2015; revised January 21, 2016; accepted January 25, 2016; published online February 8, 2016.

Y.Y. has nothing to disclose. X.L. has nothing to disclose. Y.O. has nothing to disclose. G.L. has nothing to disclose. F.G. has nothing to disclose.

Abstract has been accepted for oral presentation (O-222) at the 71th American Society of Reproductive Medicine Annual Meeting, Baltimore, MD, October 17–21, 2015.

Reprint requests: Fei Gong, Ph.D., M.D., No. 84, Xiangya road, Changsha City, Hunan, People's Republic of China 410000 (E-mail: feigongzxy@163.com).

Fertility and Sterility® Vol. 105, No. 5, May 2016 0015-0282/\$36.00

Copyright ©2016 American Society for Reproductive Medicine, Published by Elsevier Inc.

<http://dx.doi.org/10.1016/j.fertnstert.2016.01.033>

days later or to advise the woman and her family to prepare for the next ET cycle. The mental pressure and psychological stress associated with a pregnancy of uncertain viability are significant in patients undergoing IVF-ET, therefore early knowledge of the outcome can reduce some anxiety.

The most widely accepted diagnostic criteria for a nonviable early pregnancy (<12 weeks of gestational age), such as the mean sac diameter (MSD) when no embryo is detected or the crown-rump length (CRL) when no cardiac activity is shown, are recommended by The American College of Radiologists (4) and the Royal College of Obstetricians and Gynaecologists (5). In a review (6), the guidelines for diagnosing pregnancy failure were a MSD ≥ 25 mm without an embryo or a CRL ≥ 7 mm without a heartbeat. However, not all failed pregnancies develop a 25-mm gestational sac or a 7-mm embryo (6), and these definitions are therefore associated with certain limitations (7, 8). In addition, for pregnancies in which cardiac activity is demonstrated but the mean gestational sac diameter (MSD) or CRL is smaller than the expected size, there are currently no known cutoff values for the MSD and CRL to indicate an increased risk of miscarriage.

Thus, the aim of this study was to investigate a rapid and accurate forecasting method to predict the first trimester pregnancy outcome based on the first routine ultrasound scan performed on days 27–29 after ET. Also to determine whether a repeated scan should be performed several days later based on this forecasting method.

MATERIALS AND METHODS

The institutional review board approved this study before data collection. The infertile couples included in this study underwent IVF treatment at the Reproductive and Genetic Hospital of CITIC Xiangya, Changsha Hunan, People's Republic of China, between June 2011 and March 2014.

There were 10,060 women with a single pregnancy identified in this study. The clinical characteristics, such as maternal age (MA), duration of infertility, infertility type, number of transfer cycles, embryo grade, and number of embryos transferred, were collected. The transfers were all conducted on day 3. On days 27–29 after ET, transvaginal ultrasound (TVS) was performed by a well-trained sonographer to observe the embryonic cardiac activity and measure the MSD and CRL using a GE VOLUSON 730 or an E8 (General Electric) device. The CRL was measured as the greatest length of the embryo. The gestational sac was measured in three orthogonal planes, and the mean value was recorded as the MSD. Intrauterine hematomas (IUH), diagnosed as a hypoechoic or anechoic crescent-shaped area between the chorionic membrane and the myometrium, were also recorded. The first trimester pregnancy outcome of these women was noted at 12 weeks of gestation. Ninety-seven cases were lost at follow-up. There were 1,300 cases of spontaneous miscarriage before or at 12 weeks of gestation, which were assigned to the early pregnancy loss (EPL) group, and 8,663 women with an ongoing pregnancy for >12 weeks of gestation were included in the ongoing pregnancy group.

Embryo grading system was defined as follow: grade I, blastomere sizes are regular, even division, fragmentation <5%, no multinucleation; grade II, most blastomere sizes are regular, fragmentation <20%, no multinucleation; grade III, blastomere sizes are irregular, fragmentation 20%–50%, evidence of multinucleation; and grade IV, blastomere sizes are irregular, fragmentation >50%, evidence of multinucleation. Only embryos of grade I and II were transferred at our hospital.

Comparisons of MA, duration of infertility, infertility type, number of transfer cycles, and embryo grade were performed between these two groups using a two-sample *t* test or χ^2 test. The MSD, CRL, rates of detection of cardiac activity, and IUH between the EPL group and ongoing pregnancy group were also compared using a two-sample *t* test or χ^2 test. Furthermore, cutoff values for the MSD and CRL, and their corresponding sensitivity, specificity, false-positive rate, false-negative rate, positive predictive value (PPV), and negative predictive value, were calculated using receiver operating characteristic curves. The areas under the curves (AUCs) were also recorded to evaluate the predictive value of the cutoffs. Finally, the total 9,963 cases were randomly divided into two groups to generate a training sample of 8,469 (85%) cases and a verification sample of 1,494 (15%) cases. To select the least number of predictors that most reliably distinguish between the EPL and the ongoing pregnancy groups, stepwise Bayes discriminate analysis was performed in the training samples. The variables that had significant differences between the EPL group and the ongoing pregnancy group in univariate analysis were all initially candidate variables (MA, duration of infertility, number of transfer cycles, MSD, CRL, cardiac activity, and IUH) for discriminate analysis. The classification scores for each case were calculated by applying the discriminate analysis model and each case was assigned to the group for which it had the higher classification score. The predictive values of the forecasting models were assessed using the cross-validation and verification sample cases. The Statistical Package for the Social Sciences, version 18 software program (SPSS Inc.) was used in this study for the data analysis. The significance level (α) was identified as $P < .05$ for all statistical analyses.

RESULTS

There were 8,663 cases with an ongoing pregnancy and 1,300 cases had EPL. The MA, duration of infertility, and number of transfer cycles were significantly higher in the EPL group compared with the ongoing pregnancy group (Table 1; $P < .001$). However, the distributions of the infertility type, grade of embryo transferred, and number of embryos transferred were not significantly different between the two groups (Table 1).

According to measurements made by TVS, the MSD and CRL were greater in the ongoing pregnancy group than in the EPL group (Table 2; 19.41 ± 3.52 mm vs. 13.29 ± 5.25 mm, 3.64 ± 0.83 mm vs. 1.31 ± 1.63 mm, both $P < .001$). There was a higher likelihood of cardiac activity being present in the ongoing pregnancy group compared with the EPL group (Table 2; 99.8% vs. 38.3%, $P < .001$). The IUH

Download English Version:

<https://daneshyari.com/en/article/6178477>

Download Persian Version:

<https://daneshyari.com/article/6178477>

[Daneshyari.com](https://daneshyari.com)