Non-Invasive Ultrasound Image-Based Scoring System Improves IVF Pregnancy Rates.

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Background

Endometrium:

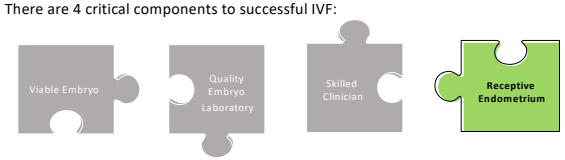
The endometrium lines the uterine cavity and undergoes dramatic changes in response to the reproductively active hormones during the menstrual cycle. Cyclic development and differentiation of endometrial glandular tissues is crucial to implantation of embryos and ultimately, maintenance of a successful pregnancy. Echotextural details of optimal cycles have been elucidated (Baerwald A, 2004; Kadash M, 2003; Pierson R, 2005).

Endometrial Receptivity:

Endometrial receptivity is defined as the physiologic condition of the uterine lining and its ability to recognize and implant an embryo or blastocyst. Endometrial receptivity assessment is currently not a standard practice in routine IVF procedures.

Corner-stones of Successful IVF:

There are 4 critical components to successful IVF:



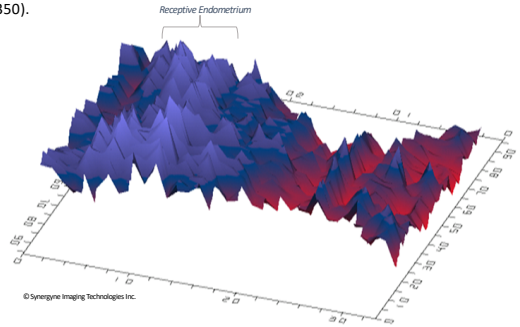
Ultimately, endometrial receptivity is a highly important aspect of successful IVF outcomes.

Ultrasound-based Endometrial Receptivity Testing:

A non-invasive *Ultrasound-based Endometrial Receptivity* test (usER) has been developed. The usER test (Matris™, Synergyne Imaging Technologies Inc.) is designed to assess the uterine lining in each IVF cycle being considered for embryo transfer. The goal of the usER test is to improve pregnancy rates and conserve embryo potential by selecting cycles with optimal probability of successful implantation for transfer.

usER-Based Cycle Selection

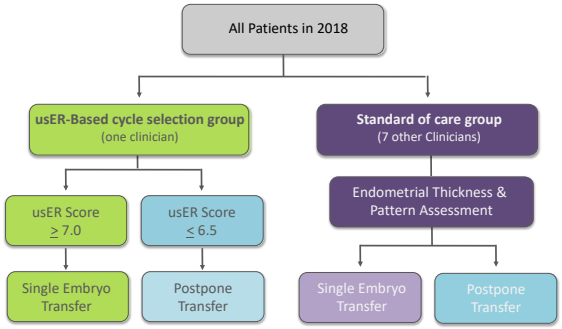
usER provides clinicians with a non-invasive real-time assessment of endometrial receptivity on a per-cycle basis. Images are analyzed and the endometrial receptivity score is reported on day 4 of progesterone, ahead of embryo transfer. Mid-sagittal and transverse images of the uterine body are obtained, the endometrial echoes are isolated and assessed through multiple filtered algorithms and 3D projections. The usER scores are generated on a 10 point scale, with lower numeric values representing low probability of pregnancy and high numeric values representing higher probability of pregnancy. High quality embryos transferred into high usER-scored endometrial environments with scores of 6.5 and higher resulted in significantly higher pregnancy rates; in previous work, approximately 20% of cycles are associated low probability endometrial scores (Pierson R, 2012). In the usER database 21 % of cycles are not optimally prepared for embryo transfer (n = 6350).



Objective

To implement the usER platform for endometrial receptivity assessment and determine the efficacy of the test over the course of one year in a real-world clinical setting. We aimed to test the hypothesis that usER-based cycle selection increases the probability of pregnancy IVF cycles.

Study Design



We compared pregnancy outcomes from one clinician utilizing the usER test for cycle selection on all cycles (n = 316) to colleagues using standard ET thickness / pattern assessments (n = 1205). All cycles in the calendar year of 2018 were considered in this analysis. The same laboratory was used for embryo generation.

Results

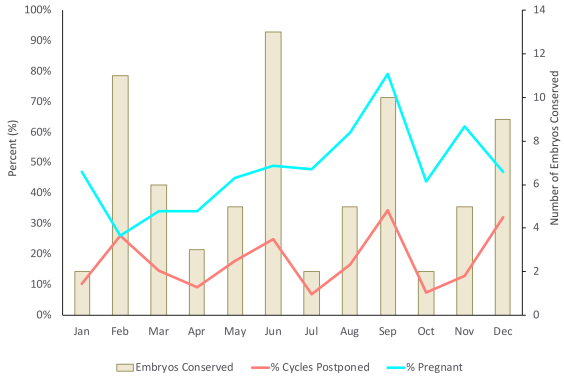


Figure 1: Pregnancy rate increases when low probability cycles identified by usER testing and postponed. The Blue Line represents pregnancy rates for usER selected cycles. The Red Line represents the percentage of cycles postponed due to low endometrial receptivity scores (as assessed by usER). The beige bars show the number of embryos conserved as a result of usER based cycle selection.

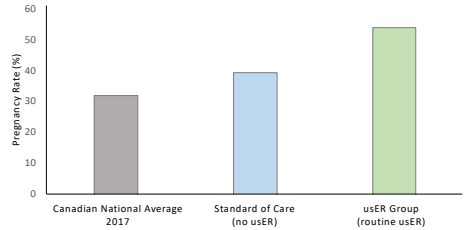


Figure 2: CFAS 2017 National Average vs Standard of Care Group vs usER Group. Comparison of pregnancy rates between Canadian National Average (2017 latest data available), standard of care group, and usER group shows increase ($p < 0.001$) in successful IVF outcomes with usER-based cycle selection.

Conclusions

Pregnancy rates in usER-based cycle were 14.6% higher compared to standard of care ($p < 0.001$). Compared to the overall Canadian national average, the usER selected cycles were 20.1% higher than those reported in the CFAS 2017 national average ($p < 0.001$).

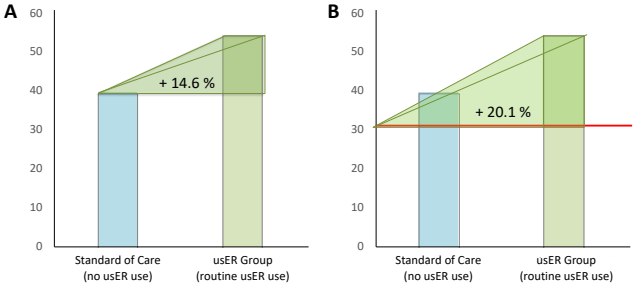
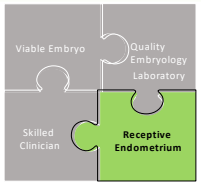


Figure 3: usER testing improves pregnancy rates. Change in pregnancy rates with routine usER-based cycle selection relative to standard of care (A) and CFAS 2017 national average (B). The Green Triangles represent the change in pregnancy rate. The red lines denote the CFAS 2017 Canadian National Average.

Impact of Findings



usER-based cycle selection provides:

- Reliable 'present cycle' rationale for cycle selection
- *Significantly* improves successful IVF outcomes (14.6 % - 20.1 % increase in pregnancy rate)
- Preservation of embryo potential

References:

1. Pierson, R.A. et al. (2012). Endometrial quality at the end of controlled ovarian stimulation predicts ongoing pregnancy rate after transfer of a single expanded or hatching/hatched blastocyst on day 5 in a fresh cycle. Fertil Steril *98*, S225.
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4. Pierson, R.A., M. Kadash, and A.R. Baerwald. 2005. Computer-assisted Three-dimensional Analysis of Endometrial Ultrasound Images Across the Menstrual Cycle. 15th World Congress on Ultrasound in Obstetrics and Gynecology. Abstracts:314.

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