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CLINICAL IMPLEMENTATION OF ALGORITHM-BASED EMBRYO SELECTION USING MULTI-DIMENSIONAL ANALYSIS OF 'BIG DATA' IMPROVES PREGNANCY OUTCOMES IN SINGLE THAWED EUPLOID EMBRYO TRANSFERS (EUPLOID SETS)

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OBJECTIVE: Preimplantation genetic testing for aneuploidy (PGT-A) enables modern assisted reproductive technology treatment centers to better identify and select embryos for transfer. However, even among euploid embryos, morphologic grading remains a significant metric for transfer selection, especially for patients who have >1 euploid embryo available (1,2). Previous work has attempted to determine the accuracy of mathematical models in predicting outcomes using transfer cycles with known clinical results (3). However, there has yet to be a study to evaluate the clinical utilization of an algorithm-based (AB) system for embryo transfer selection. We sought to assess whether AB embryo selection improves clinical outcomes in euploid SETs.

DESIGN: Retrospective cohort study

MATERIALS AND METHODS: The study included patients who underwent euploid SETs at an academic center from September 2016 to February 2020. Controls included euploid SETs in which a senior embryologist selected the embryo for transfer based on modified Gardner grading (traditional). Cases included euploid SETs in which the embryo was selected using an automated AB approach. Exclusion criteria were euploid SETs from July 2017 to January 2018, in which a mixture of traditional and AB selection were used. The algorithm created a weighted ranking system of each embryonic parameter (expansion, inner cell mass grade, trophectoderm grade) and formulated a composite score. The embryo with the highest score was transferred. Our primary outcome was implantation rate (IR). Secondary outcomes were ongoing pregnancy/live birth rate (OP/LBR), biochemical pregnancy rate (BPR) and clinical loss rate (CLR). Baseline demographics were obtained: age, body mass index (BMI), ovarian reserve testing, obstetric history, endometrial thickness (EnT) and progesterone level (PL) at time of

transfer, and embryo grade. Data were analyzed using Student's t-test, chi-squared test, and logistic multivariable generalized estimating equation regression models, with $P<0.05$ considered significant.

RESULTS: 4,521 SETs were performed in the study period and met inclusion criteria (traditional: n=1,119; AB: n=3,402). Patients in the traditional group were older and had a lower BMI, PL, and EnT at time of transfer ($P<0.05$ for all); demographic data was otherwise similar. The IR and OP/LBR were significantly higher in the AB group compared to the traditional group (63.52% vs 56.93%, $P<0.0001$ and 53.13% vs 47.18%, $P=0.006$, respectively). After adjusting for age, BMI, AMH, obstetric history, EnT and PL at time of transfer, and embryo grade, use of the algorithm remained significantly associated with improved IR (OR 1.25, 95% CI 1.07-1.47) and OP/LBR (OR 1.24, 95% CI 1.06-1.45). We saw no differences in BPR or CLR.

CONCLUSIONS: This is the first study to clinically implement AB embryo selection in euploid SETs. Our results demonstrate that utilization of a mathematical model for embryo selection improves clinical outcomes. Future studies implementing the algorithm in prospective, randomized trials are warranted and would better delineate the role of our model in embryo selection.