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APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGY TO INCREASE THE EFFICACY OF EMBRYO SELECTION AND PREDICTION OF LIVE BIRTH USING HUMAN BLASTOCYSTS CULTURED IN A TIME-LAPSE INCUBATOR.

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OBJECTIVE: To apply artificial intelligence (AI) technology on timelapse (TLM) morphokinetic parameters and TLM embryo images to enhance embryo selection and prediction of live birth.

DESIGN: The morphokinetic parameters (n¼ 303, ICSI only) of embryos associated with live births resulting from single blastocyst transfers, along with 386 TLM images of embryos at 111.5 hours post ICSI were used to train (70%), validate (15%), and blindly test (15%) for the ability to predict live birth by an AI feature-extraction system. Inclusion criteria involved good-prognosis patients with single blastocyst transfer and non- PGD/S.

MATERIALS AND METHODS: Absolute and interim cleavage time points (t2 to t8) were used, along with 33 independent numerical variables extracted from standardized EmbryoScope images (Virtolife, Sweden) as input data. The artificial neural network (ANN) architecture associated e372 ASRM Abstracts Vol. 110, No. 4, Supplement, September 2018 with the genetic algorithm was used to produce a predictable output of live birth. The efficacy of prediction of live birth was quantified and assessed using ROC curves, AUC, and confusion matrices (true positive, TP; true negative, TN; false positive, FP; and false negative, FN).

RESULTS: Using morphokinetic data, we achieved 83% overall accuracy of predicting live birth by AI (215/258; TP¼ 99, TN¼ 106, FP¼ 22, FN¼ 21, AUC¼ 0.91). In the training dataset, the accuracy was 85% (181/213, AUC 0.91), and in the blind test data set, the accuracy was 76% (34/35, AUC¼0.77). The overall accuracy of live birth by AI using image analysis was 85% (280/328, TP¼ 138, TN¼ 142, FP¼ 25, FN¼ 23, AUC¼ 0.90). In the training dataset, the accuracy was 87% (235/270, AUC 0.92), and in the blind test data set, the accuracy was 78% (45/58, AUC¼0.67-0.80). For morphokinetics, the AUC for positive and negative live birth was similar (0.90); however, for image analysis, the negatives (0.67) were harder to predict compared to the positives (0.80).

CONCLUSIONS: This is the first time that AI has been used to evaluate human embryo quality using morphokinetic and morphological assessment in a controlled data set of single embryo transfers with known live birth. Our data suggest that AI can be used to enhance the efficacy of embryo selection beyond the limits of current practice. Applying AI in conjunction with morphokinetic and image analysis has the potential the become the universal platform, as exhibited by its consistency, efficacious embryo selection, and can be prospectively applied in any clinic, regardless of its practice or patient base.