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In-House Developed AI for Embryo Selection Increases Ongoing Pregnancy Rate

Background

- Morphokinetics are being used to develop AI algorithms for embryo selection.
- These AI systems are reproducible and non-invasive with the addition of timelapse incubation in the IVF laboratory.
- The differences in morphokinetic timings are used as selection criteria for embryo transfer in addition to morphology.

Objective

To assess the effect of an in-house developed AI for embryo selection on cycle outcomes.

Materials and Methods

163 elective single frozen embryo transfers (eset FET) utilized the algorithm score as the sole source of embryo selection criteria when multiple embryos were frozen and available for transfer. All cycles included embryos vitrified at the blastocyst stage on day 5/6 with embryo grades of A or B for both the inner cell mass and trophectoderm. Pregnancy and ongoing pregnancy outcomes were compared with 128 non-algorithm selected eset FET cycles that were performed during the same time period with the same embryo criteria. In these cycles, algorithm scores were not available to aid in embryo selection and morphology and day of vitrification were used as the selection tools. Cycle outcomes for all FET cycles, for PGT Euploid only transfers, and for non PGT tested cycles were grouped for comparison.

Morphokinetic timings post insemination of second polar body extrusion, pronuclear appearance, pronuclear fading, cellular division at the 2, 3, 4, 5, 6, 7, 8 cell stages, start of compaction, morula formation, start of blastulation, expanded blastocysts with inner cell mass and trophectoderm grading were assessed. Based on these morphokinetic timings, each embryo is given an algorithm score 1 (lowest) - 10 (highest). Embryo selection for transfer is based on the algorithm score of the individual embryo.

	n	positive hcg	sac formation	fca/ongoing pregnancy
All cycles with AI	163	65	56	52
All cycles without AI	128	61	51	44
No PGTA with AI	26	63	62	54
No PGTA without AI	35	59	51	40
PGTA with AI	137	66	57	53
PGTA without AI	93	64	51	46

Results

- Initial pregnancy rate (65%, 61%) and gestational sac formation (56%, 51%) showed no significant difference between the algorithm selected and non-algorithm selected eset FETs, but did show a positive trend upwards.
- Transfers utilizing algorithm selection had a significantly ($p< 0.1$) higher ongoing pregnancy rate (52%) compared to the traditional selection FETs (44%).
- When comparing the PGTA Euploid FET subset of each group, we see similar initial pregnancy (66%, 64%) and sac (57%, 51%) rates, however there is an increase in ongoing pregnancy rate with a positive fca in the algorithm selected FET group (53%, 40%).
- The same trend appears in the data when non-PGTA transfers are parceled out in each group comparing initial pregnancy rates (63%, 59%), sac formation (62%, 51%) and ongoing pregnancy (54%, 40%) rates.

Conclusions and Key Points

- AI assisted embryo selection using the algorithm showed a significant positive impact on ongoing eset FET rates compared to eset FET cycles that did not utilize algorithm embryo selection.
- Cycle numbers were too small to see any impact of the individual algorithm scores (1-10) on transfer outcomes at this time, and we will continue to assess as cycle numbers increase.
- The majority of cycles performed utilized PGTA in patients of all ages. The cycles where PGTA was not utilized were small in number. Outcome data was not corrected for any additional factors such as maternal age, AMH, BMI, RPL, or uterine disorders.

References

Campbell A, Smith R, Petersen B, Moore L, Khan A, Barrie A. O-125 Application of artificial intelligence using big data to devise and train a machine learning model on over 63,000 human embryos to automate time-lapse embryo annotation. Human Reproduction. 2022 Jul 1;37(Supplement_1): deac105-025.

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