Abstract Details

Session title: Session 49: Embryo metabolism and development

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What can we learn from the first 24 hours of embryo development? A fully automated AI-based algorithm for identifying high-quality blastocysts.

Biography

Daniella Gilboa, CEO, and Co-founder of AiVF, is an embryologist, biostatistician, entrepreneur and an IVF researcher. Her vast experience in embryology led her to co-found AiVF, together with two renowned IVF physicians, Prof. Daniel Seidman and Prof. Eyal Schiff. AiVF develops a data and AI-driven comprehensive platform for IVF treatment process. Prior to AiVF Daniella worked as a Global Senior Biostatistician at Teva Pharmaceuticals and as a senior embryologist at Assuta Medical Center. Daniella speaks worldwide on IVF in general as well as utilizing deep technology for IVF.

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Study question:

Can an AI-based system that analyses the first 24 hours of embryonic development open, for the first time, a window to the development of the embryo?

Summary answer:
Using AI algorithms we have shown that a combination of previously unrecognized features within 24 hours after fertilization can help identify high-quality blastocyst

What is known already:
Embryos examined on the first day after retrieval are usually classified as viable or atretic. However, little more can be established regarding their future development, based on routine morphological studies. All AI algorithms developed so far for embryo selection are based on time-lapse video analysis of cleavage stage embryos. Oocyte and zygote stage visual assessment was not used so far for the prediction of embryo quality.

Study design, size, duration:
A retrospective analysis of the first 24 hours of embryo development based on 1560 consecutive time-lapse videos from a single IVF center.

Participants/materials, setting, methods:
Using computer vision algorithms, we identified unique features, some of which were never before recognized, during the first 24 hours of embryonic development. We then developed an automated AI algorithm to extract and measure these features from time-lapse videos. A deep neural network was developed based on the parameters recognized by the computer vision module for each image. A classifier was used to match these parameters to the endpoint, high-quality blastocysts.

Main results and the role of chance:
Our model was able to predict high-grade blastocysts on day 5 using only day-1 time-lapse data with an AUC of 0.665 [95% CI 0.650-0.681] and 10-fold stratified cross-validation of the training set. Our test

results showed that the AUC was reproducible. These results are comparable to studies attempting to make similar predictions based on a much longer observation period of cleavage stage embryos.

Limitations, reasons for caution:
Future prospective validation of our AI algorithm is required using different patient populations, although the number of embryos analyzed is outstanding.

Wider implications of the findings:
Our results broaden the understanding of the potential capabilities for IVF of newly introduced AI systems. We showed that a deep neural net can solve one of the most challenging tasks, distinguishing between top-grade embryos, solely based on unique visual features identified in the first 24 hours after fertilization.

Keywords:
Deep Neural Network
computer vision
embryo selection
blastocyst
Embryonic Development