P-535 Machine learning classification algorithms can predict the ploidy status on day 5 and 6 with a 79% accuracy using evolutive morphological parameters and patient age

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Study question: Can Machine Learning predict ploidy status from embryo evolutive morphological parameters in a non intrusive way?
Summary answer: Reporting cumulative embryo scoring from early development days and feed it to machine learning algorithms can help better predict the ploidy status of embryos
What is known already: Wiemer and Kelley showed morphological parameters and development rates were important parameters to consider during the embryo transfer process. Minasi et al. showed morphology assessment at blastocyst stage was correlated with ploidy status. Chavez-Badiola et al. showed a deep learning algorithm could predict the embryos ploidy with an accuracy of 70% and with positive predictive value of 0.79 using labeled blastocysts images.
Study design, size, duration: Study was a retrospective cohort analysis from 2019 to 2020 of 2520 biopsied embryos (669 cycles) cultured at POMA fertility clinic. Observations included all autologous embryos undergoing PGTA on day 5 or 6 with known PGTA status. Embryos from donors and with undefined PGTA results were excluded from the study. The embryos were classified as either euploid (n=1528) or displaying a chromosomal anomaly (n=992)
Participants/materials, setting, methods: Input of the machine learning model included patient age and 19 morphological parameters collected on days 1, 2, 3, 5 and 6 (symmetry, number of cells, blastocyst status, fragmentation, ICM and troph grades). An xgboost algorithm was trained on 80% of the data (n= 2016) and tested on 20% of blind data (n=504).
Main results and the role of chance: Xgboost machine learning algorithm managed to predict ploidy status on the blind dataset with an accuracy of 79%, significantly higher than random chance (AUC= 0.71) and a positive predictive value of 87%.

Blastocyst stage parameters that are usually monitored to assess embryo quality (ICM, troph and blastocyst status on days 5 and 6) ranked high in the predictive power of the machine learning algorithm. It appeared that despite moderate to small individual correlation with the ploidy status, including parameters on day 1 (including number of PNs and number of cells on day1 PM check) to day 3 increased the performance of the classification algorithm from 70% accuracy to 79% accuracy. Machine learning algorithms are able to exploit evolution of morphological parameters during the development to improve the prediction.
Limitations, reasons for caution: Dataset was derived from one single clinic with manual annotations. Results should be validated on more clinics and inter-operator variation in morphological parameters annotation should be assessed to confirm robustness of the model and increase its predictive power.
Wider implications of the findings: Study shows the potential of detecting ploidy status in a non intrusive way and participating to embryo selection. Study confirms the importance of annotating morphological parameters of embryos in the early days of development.
Trial registration number: not applicable