# Prediction of blastocyst ploidy from 2,438 images of mature oocytes using an artificial intelligence (AI)-based algorithm: a validation study

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## Study question

Can an AI-based algorithm predict blastocyst ploidy from oocyte images acquired immediately post-ICSI?

## Summary answer

The ploidy-AI algorithm was able to distinguish oocytes that developed into euploid and aneuploid blastocysts, achieving an area under the curve (AUC) of 0.69.

## Study design, size, duration

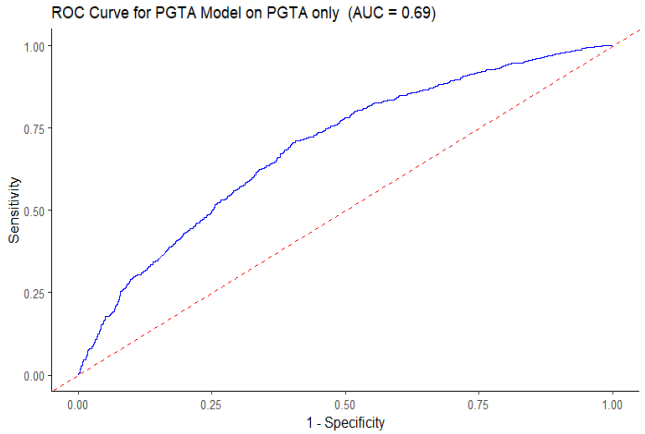
| Variable | Total |
|---|---|
| Mean age ± SD (years) | 38.9 ± 4.2 |
| Patients (n) | 577 |
| PGT-A cycles (n) | 644 |
| Oocytes (n) | 2438 |

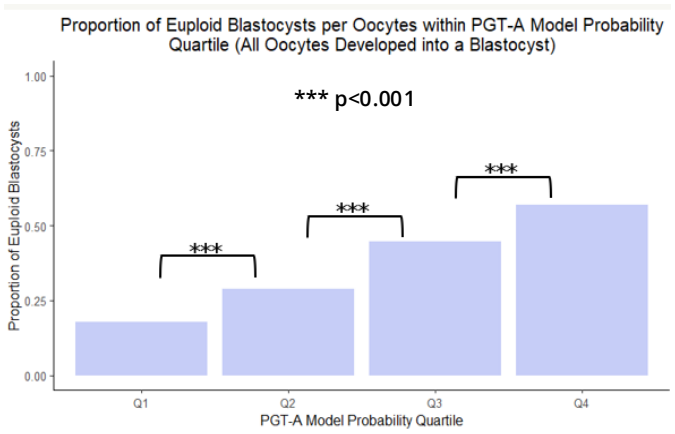
Cycles from January 2019 to July 2024 across two centers.
Oocyte images, acquired immediately post-ICSI via time-lapse, were analyzed using the ploidy-AI algorithm, which assigns a probability (0-100%) for an oocyte to develop into an euploid blastocyst.
Only images from oocytes that progressed to the blastocyst stage and underwent PGT-A were included in the validation dataset.

## Participants/materials, setting, methods

Oocyte ploidy-AI predictions were compared with actual blastocyst ploidy outcomes. ROC curves were used to evaluate prediction accuracy (AUC). Euploidy rates were stratified into quartiles (Q1-Q4) of AI probability scores for a deeper analysis of the correlation and compared using two-proportion z-tests. Analyses were performed in R ($p<0.05$ = significant).

## Main results




The ploidy-AI algorithm achieved an AUC of 0.69 (sensitivity=0.38; specificity=0.84). Significant differences in euploidy rates were observed across quartiles: Q1 (17.7%), Q2 (28.7%), Q3 (44.7%), and Q4 (57.0%). Higher ploidy-AI model probabilities consistently correlated with an increased likelihood of euploidy, demonstrating the model's ability to provide meaningful insights into chromosomal outcomes. While the quartile thresholds are specific to this data set, the observed trends highlight the model's potential as a non-invasive support tool in predicting blastocyst ploidy from oocyte.

## Limitations, reasons for caution

The ploidy-AI algorithm was trained on PGT-A cycles that included oocytes that did and did not develop into blastocysts. However, the study excludes those that did not reach the blastocyst stage or undergo PGT-A, which may underestimate its predictive capacity.

## Wider implications for the findings

The ploidy-AI algorithm demonstrated encouraging potential for predicting blastocyst ploidy, offering a non-invasive tool to manage patient expectations early in the IVF process. By offering immediate insights into oocyte quality, the model may assist in treatment decisions and enhance patient counselling, particularly for patients undergoing or considering PGT-A.