

An artificial intelligence (AI) deselection model for top-quality blastocysts: Algorithmic analysis of morphokinetic features for aneuploidy may increase implantation rates

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Introduction

Our previously published results (ESHRE 2021) demonstrated that aneuploid blastocysts were more likely to reach development events (t2-t8) later, and that the timing between each event was statistically longer (p<0.001), when compared to euploid embryos.

Given that delayed morphokinetic rates are tightly linked to ploidy, we investigated whether these known morphokinetic features can predict implantation failure in top-quality blastocysts with unknown ploidy.

Objective

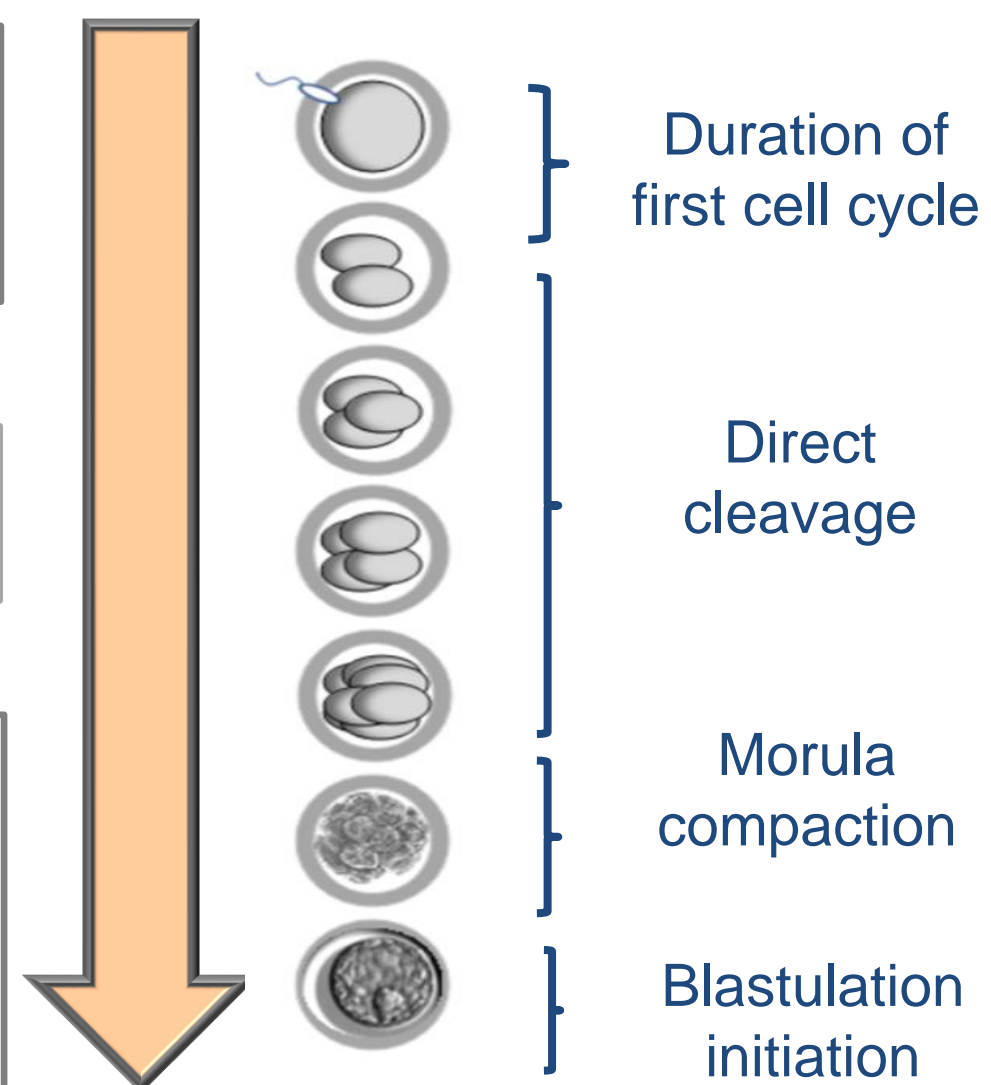
To determine whether an algorithmic deselection model based on morphokinetic features associated with aneuploidy can predict implantation failure in top-quality blastocysts.

Materials and Methods

Time-lapse sequences of 3,259 top-quality blastocysts from fresh single embryo transfer cycles with known implantation outcomes

Automated measurements of the rate of mitotic division events

Compare the number of embryos in each category (implanted/nonimplanted) that reached each developmental event at least one standard deviation (SD) later than the mean for implanted embryos



Results

Average time for implanted top-graded blastocysts to reach each morphokinetic event

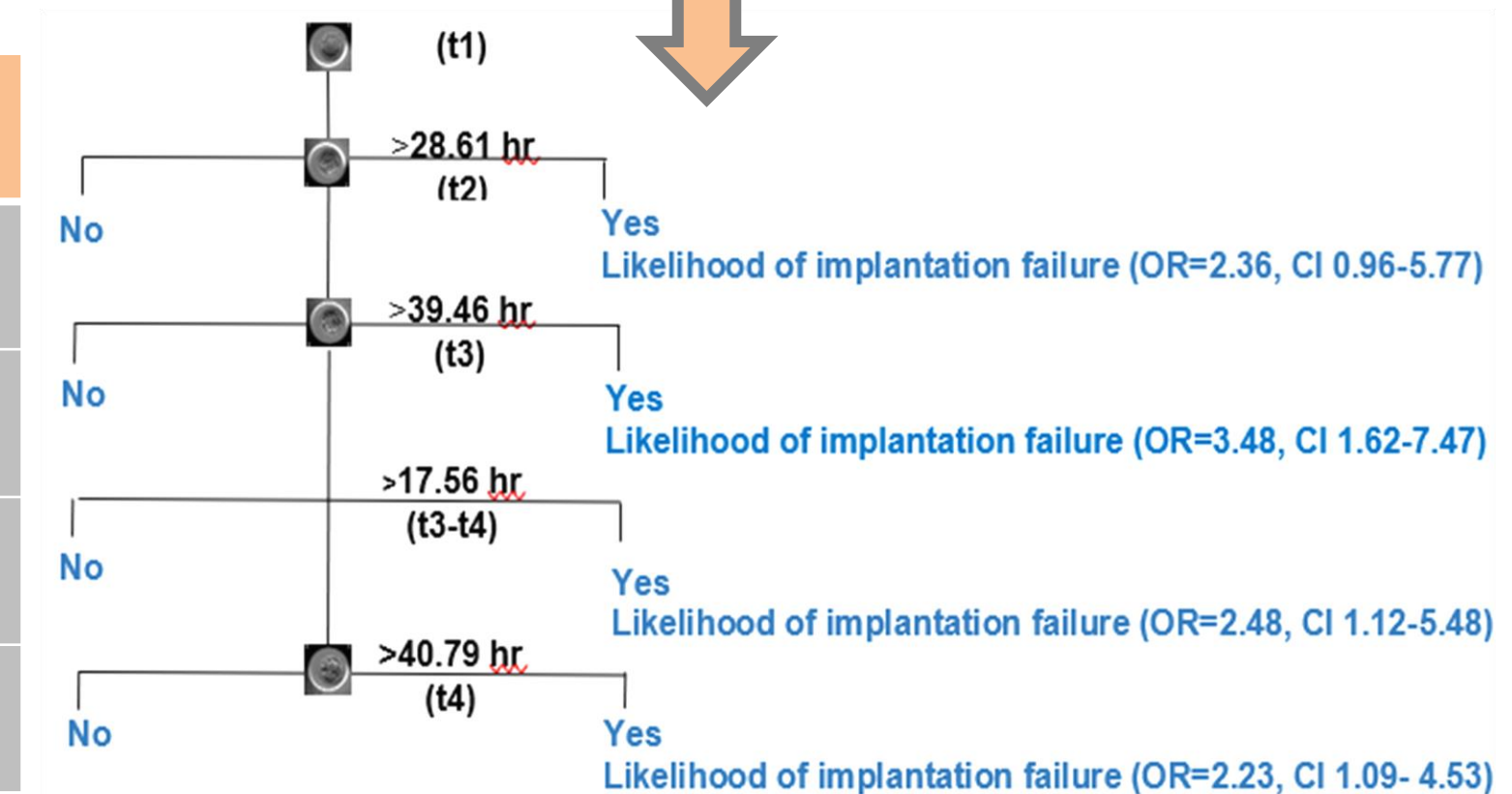
Morphokinetic Event	t2	t3	t4	t3-t4
Mean Hour ± SD	25.23 ± 3.8	36.06 ± 3.4	37.14 ± 3.6	12.25 ± 5.31

Average cutoff times that associate with likelihood of implantation failure in top-graded blastocysts

	Mean hr	OR	95% CI	P-Value
t2	28.61	2.36	0.95-5.77	<0.001
t3	39.46	3.48	1.62-7.47	<0.001
t4	40.79	2.23	1.09-4.53	<0.001
t3-t4	17.56	2.48	1.12-5.48	<0.001

Results showed statistical differences in the timings of the following morphokinetic variables between the two categories (implanted/nonimplanted): t2, t3, t4, and t3-t4 (p<0.05).

Given this, we propose cutoff values (in hours) that differentiated between non-implanted and implanted top-graded blastocysts based on their morphokinetic profiles.



These cutoff values were incorporated into the algorithm for optimized deselection of morphologically similar top-quality blastocysts with delayed morphokinetic profiles.

Conclusions

Our algorithmic model demonstrates for the first time the utility of an AI tool to deselect top-graded blastocysts that would otherwise be selected for transfer based on conventional morphologic assessment alone.