

The impact of mitochondrial DNA on embryo transfer outcomes

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Objective

Limited evidence is available regarding the influence of mitochondrial DNA (mtDNA) on embryo implantation, and its relationship to outcomes remains controversial. The goal of our study is to further elucidate the association between the amount of embryonal mtDNA and implantation.

Design

Retrospective cohort analysis.

Materials & Methods

- We performed a retrospective chart review of subjects whose embryos underwent preimplantation genetic screening (PGS) prior to single embryo transfer in our center between 2013 and 2016.
- A total of 153 embryo transfers from 144 subjects were included.
- We compared mtDNA content—ratio of mtDNA to nuclear DNA—between No Implantation and Implantation groups.
- Secondary outcomes of interest were clinical and ongoing pregnancy.
- Multinomial logistic regression was used for data analysis between dependent categorical outcomes and continuous dependent variables.
- In attempt to identify an amount of embryonal mtDNA predictive of implantation, the mtDNA was divided into percentiles.
- Fisher's exact, Pearson's chi-squared, or Wilcoxon rank-sum was used as appropriate with $P < .05$ considered significant.

Results

- The Implantation and No Implantation groups were similar with respect to age, BMI, and gravida and para (Table).
- Although there was no statistically significant difference in mtDNA content between the Implantation and No Implantation groups ($P = .29$), upper quartile percentiles of mtDNA content were inversely proportional to implantation rates:
 - Upper 75th percentile:
 - 25% vs 13%; $P = .05$;
 - Upper 90th percentile:
 - 20% vs 10%, $P = .07$; and
 - Upper 95th percentile,
 - 5% vs 0%, $P = .05$ (Table)
- No associations were observed between mtDNA content and clinical or ongoing pregnancy (data from logistic regression analyses not shown).

Characteristics	No Implantation (N=59)	Implantation (N=94)	P value*
Age (y)	35 (32–39)	34 (32–37)	.32
BMI (Kg/m ²)	25 (22–29)	26 (22–31)	.26
BMI >30 (Kg/m ²)	24 (40%)	30 (30%)	.184
Ethnicity			.04
White	27 (52%)	65 (73%)	
Black	5 (9%)	3 (3%)	
Hispanic	11 (21%)	8 (9%)	
Asian	9 (17%)	13 (14%)	
Gravida	1 (0–2)	1 (0–2)	.26
Para	0 (0–1)	0 (0–1)	.6
Mitochondrial DNA	0.000618 (0.000385–0.00129)	0.000644 (0.000363–0.000995)	.29
mtDNA25 (25 th percentile or less)	13 (23%)	25 (25%)	.83
mtDNA10 (10 th percentile or less)	2 (3%)	10 (10%)	.123
mtDNA5 (5 th percentile or less)	0	5 (5%)	.159
mtDNA75 (75th percentile or more)	15 (25%)	13 (13%)	.05
mtDNA90 (90 th percentile or more)	12 (20%)	10 (10%)	.07
mtDNA95 (95th percentile or more)	3 (5%)	0 (0%)	.05
mtDNA99 (99 th percentile or more)	1 (1%)	0 (0%)	.37

Mitochondrial DNA is defined as a ratio of nuclear DNA/mtDNA.

Conclusions

- This is the largest study to evaluate the relationship between embryonal mtDNA content and embryo transfer outcomes.
- In contrast to some prior published studies, our data did not show an association between mtDNA content and implantation.
- We did find that embryos with mtDNA content in the upper quartile percentiles were less likely to implant.
- However, cut-offs for mtDNA content predictive of implantation or failure could not be established.
- These data are limited to high-quality embryos selected for transfer, and prospective clinical studies are needed.