TITLE: THE OPTIMAL NUMBER OF MATURE OOCYTES NEEDED TO OBTAIN THREE EUPLOID BLASTOCYSTS FOR HIGH LIKELIHOOD OF A LIVE BIRTH

Authors: Namath A (1), Flannagan K (2), Pirtea P (3), Toner J (4), Devine K (2)

Affiliations: (1) National Institutes of Health, Bethesda MD, (2) Shady Grove Fertility Center, Rockville, MD (3) Department of OB/GYN Hopital Foch, Suresnes, France (4) Emory University, Atlanta, GA

Background

More patients are thawing their cryopreserved oocytes, but recommendations are limited on how many oocytes are needed. Validated calculators have been published to counsel on the minimum number of mature oocytes (MII) needed for one euploid embryo for transfer (1). However, recent literature demonstrated there is a >90% chance of live birth if patients have at least *three* euploid embryos (2). There are currently no studies demonstrating how many vitrified MIIs are required to achieve at least three euploid blastocysts to get patients the best chance of live birth.

Objective:

To determine the optimal number of mature oocytes required to obtain 3 or more euploid blastocysts available for transfer.

Materials and Methods

This was a retrospective cohort study at a multi-center ART practice with all patients who underwent oocyte cryopreservation that thawed from 2011 to 2023. We collected baseline demographics, including measures of ovarian reserve. Our primary outcome was the number of mature oocytes cryopreserved in patients with at least three euploid embryos. Our secondary outcomes were total number of euploid embryos and live birth outcomes.

Results

Patients were stratified by age at time of cryopreservation with 1,041 total cycles. Measures of ovarian reserve were appropriate for age (Table 1). We evaluated the minimum number of MIIs needed to get a specific percentage chance of 3 or more euploid blastocysts based on our data (Figure 1). For a 70% chance of obtaining at least three euploid blastocysts to theoretically have a >90% chance of live birth, patients need to bank 15-20 MIIs if less than age 35 at time of cryopreservation, 20-25 MIIs if aged 35-37, 30-35 MIIs if aged 38-40, 35-40 MIIs if aged 41-42, and more than 50 MIIs if aged 43 or older (Figure 1).

Conclusions

This study gives real world expectations on the optimal, minimum number of MIIs required to obtain three euploid blastocysts, stratified by age. From our analysis, 15 MIIs are needed if patients are less than 35 at time of cryopreservation or 20-35 MIIs if aged 35-40 for a 70-80% chance to bank three euploid blastocysts for >90% chance of live birth.

Support

None

References:

1. Esteves SC, Carvalho JF, Bento FC, Santos J. A Novel Predictive Model to Estimate the Number of Mature Oocytes Required for Obtaining at Least One Euploid Blastocyst for Transfer in Couples Undergoing in vitro Fertilization/Intracytoplasmic Sperm Injection: The ART Calculator. *Front Endocrinol (Lausanne)* 2019; 10: 99.

2. Pirtea P, De Ziegler D, Tao X, Sun L, Zhan Y, Ayoubi JM, Seli E, Franasiak JM, Scott RT, Jr. Rate of true recurrent implantation failure is low: results of three successive frozen euploid single embryo transfers. *Fertility and Sterility* 2021; 115: 45-53.

Table 1: Demographics by age at cryopreservation

	<35	35-37	38-40	41-42	43+
N cryopreservation cycles	310	334	283	77	37
Age at cryopreservation, mean (SD)	31.3 (2.5)	36 (0.8)	38.9 (0.7)	41.4 (0.5)	43.7 (1.3)
Age at thaw, mean (SD)	33.9 (4)	39.6 (2.6)	41.9 (2.4)	43.5 (2.1)	44.8 (2.1)
BMI (kg/m^2), mean (SD)	25.5 (5.4)	25.3 (4.7)	25.9 (4.7)	26.9 (5.3)	26.7 (6.7)
Maximum FSH (mIU/mL), median (IQR)	7 (5, 9)	8 (5.8, 9)	8 (6, 9)	8.7 (6, 10)	9 (7, 11.7)
Antral follicle count, median (IQR)	19 (13, 28.3)	16 (11, 23)	16 (11, 22)	14 (8, 18)	11 (5.8, 18.5)
AMH, median (IQR)	2.9 (1.4, 5.3)	1.6 (0.8, 3.3)	1.7 (1, 3.2)	0.9 (0.6, 1.7)	0.9 (0.5, 2.1)
Number of MII oocytes banked, median (IQR)	13 (6, 19)	14 (8, 21)	13 (6, 21)	10 (5, 22)	4 (1.8, 13.5)
%2PN embryos, mean (SD)	72 (23.1)	71 (19.4)	71 (20.9)	68.8 (22.4)	74.4 (22.8)
Used PGT, N (%)	103 (33.2)	183 (54.8)	153 (54.1)	36 (46.8)	13 (35.1)
%euploid embryos, mean (SD)	62.2 (27.1)	54.8 (31.4)	42.4 (30.1)	30.3 (30.5)	35 (34.6)

Figure 1: Predicted probability of at least 3 euploid blastocysts based on number of MII oocytes, stratified by age