

Oocyte Cryopreservation

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Irregular oocyte swelling time in thawing solution (TS) highly correlates with the subsequent survival rate

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Study question

Whether irregular thawing time in thawing solution (TS) correlates with the following oocyte survival rate?

Summary answer

Irregular oocyte swelling time in TS dramatically increases and highly correlates with the mortality after thawing.

What is known already

Vitrification is an optimal method employed for oocyte preservation to prevent intracellular and plasma membrane molecules such as enzymes, structural protein and mRNA damage from ice crystals. The critical process of oocyte vitrification is considered to exchange water and cryoprotectant between intracellular and extracellular environments. Membrane integrity is supposed to be one of the major reasons influencing water/cryoprotectant exchange rate and following survival rate after thawing.

Study design, size, duration

A retrospective cohort study throughout June 2017 to November 2017, total of 2,144 oocytes in 162 cryopreservation/thawing cycles were included. The timing of swelling, flattening and recovering time in thawing solution were recorded and analyzed to reveal the effects on the thawing outcomes.

Participants/materials, setting, methods

Every oocyte undergone thawing procedure were recorded with the individual timing of swelling, flattening and recovering (swelling combined with flattening). All the oocytes were classified according to the (1. thawing outcomes-survival or mortal to reveal the timing diversity; or (2. regular (>30s) or irregular (\leq 30s) swelling time in TS to compare the mortality.

Main results and the role of chance

Based on the thawing outcomes, firstly, oocytes were grouped into survival and mortal groups for comparing the swelling, flattening and recovering time of the two groups.

The results indicated that the mean time of swelling (44.1s vs. 29.0s, $p < 0.001$) and total

recovering (56.7s vs. 39.4s, $p < 0.001$) in survival group was significantly higher than the mortal group. The primary disparity of recovering time were mainly derived from the swelling time, although the average flattening (12.6s vs. 10.4s, $p = 0.07$) time of survival group was also significant higher than the mortal group. Secondly, in the contrary, thawed oocytes were classified according to swelling time (regular, $>30s$ or irregular, $\leq 30s$). Mortality of the regular group revealed significantly lower than the irregular group (2.7% vs. 27.2%, $p < 0.001$). Taken together, the two aspects indicated that the swelling time is a critical indicator correlating to the mortality of oocyte thawing. These observations implicated that osmotic potential plays a critical role affecting the thawing survival rate. Furthermore, membrane permeability and surface molecular profile might influence cell resistant from osmotic potential, which accounts for the dramatically increasing mortality.

Limitations, reasons for caution

Vitrification strategy was adopted in all the frozen-thawed oocytes in this study. Vitrification Kit 101 (Cryotech) and Warming Kit 102 (Cryotech) were employed for performing frozen-thawed procedures. The phenomenon should be observed in other vitrification strategy but might fail to refer to other frozen-thawed methods such as slow freezing process.

