

A REVIEW ON EGG VITRIFICATION

Anindita Das

Clinical Instructor College of Nursing, Medical College & Hospital, Kolkata

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ABSTRACT

Egg vitrification is a process through which mature eggs or ova are collected and frozen for future usage. Women suffering from any gynecological problems, plans to late marriage, deciding to remove their ovaries, or not ready to marry but want to have babies can undergo this procedure. After collection, the ova are kept in liquid nitrogen at -196 degree celcius. Several tests including USG are done. Ovarian stimulation is done by hormone preparations, then they are retrieved by TVS Ultrasound aspiration. Women may complain of mild abdominal pain following the procedure. Younger age of the women has a higher success rate. Researches have shown that vitrification has more success rates than slow freezing of the eggs.

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INTRODUCTION

Egg freezing, or oocyte cryopreservation, is a fertility preservation technique where eggs are extracted from the ovaries and frozen so they can be used for an assisted reproductive technology (ART) procedure, like in-vitro fertilization (IVF), in the future. It is a method used to save a woman's ability to get pregnant in the future.¹

Candidates for egg vitrification

- Women suffering from uterine, ovarian or endometrial cancer or undergoing radiation or Chemotherapy.
- Women with Turners syndrome leading to premature ovarian failure
- Women, who want babies at later stage because of their career choices
- Women, not willing to get married or having a partner but want to have babies
- Lesbian women, willing to have babies
- Women deciding to remove their ovaries because of presence of BRCA gene
- Any treatment that can lead to infertility for the women. (sickle cell anemia, autoimmune diseases such as lupus, and gender diversity, such as being transgender.)²

The Oocyte Vitrification Procedure

The process of vitrification involves processing the oocyte with an increasingly stronger solution of cryoprotectants freezing (or antifreeze) to dehydrate and prepare it for freezing.

The oocytes are then flash frozen. Afterwards, they are kept in liquid nitrogen at -196 °C or -321 °F. Recent studies show that the more mature the egg or oocyte is, the more successful the process will be. Freezing the egg can cause a hardened shell, which is why it must be injected by sperm instead of just placed in the uterus. The mitotic spindles, structures crucial to cell division, can become disrupted.³

After the oocyte is thawed, it is injected with sperm to fertilize the egg. Once fertilized, the egg will be placed into the woman, similar to IVF, or in vitro fertilization. The rate of pregnancy with oocyte vitrification is different for each woman, depending on how mature the egg is and how long it was frozen.³

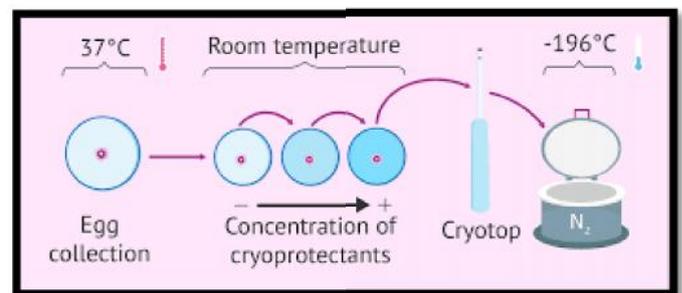


Fig 1 Egg vitrification⁴

Risks related to egg cryopreservation

Egg freezing carries various risks, including:

Conditions related to the use of fertility drugs. Rarely, use of injectable fertility drugs, such as synthetic follicle-stimulating hormone or luteinizing hormone to induce ovulation, can cause the ovaries to become swollen and painful soon after ovulation

*Corresponding author: **Anindita Das**

Clinical Instructor College of Nursing, Medical College & Hospital, Kolkata

or egg retrieval (ovarian hyperstimulation syndrome). Signs and symptoms include abdominal pain, bloating, nausea, vomiting and diarrhea. Even rarer that can be life-threatening.

- **Egg retrieval procedure complications.** Rarely, use of an aspirating needle to retrieve eggs causes bleeding, infection or damage to the bowel, bladder or a blood vessel.
- **Emotional risks.** Egg freezing can provide hope for a future pregnancy, but there's no guarantee of success.⁵

How to prepare a candidate for the procedure

- **Ovarian reserve testing.** To determine the quantity and quality of the eggs, the concentration of follicle-stimulating hormone and estradiol in blood on day three of the menstrual cycle. Results can help predict how ovaries will respond to fertility medication.
- **USG:** USG of the ovaries might be used to get a more complete picture of ovarian function.
- **Infectious disease screening.** Screening for HIV and hepatitis B and C are done.

Steps for egg freezing

Egg freezing has multiple steps-ovarian stimulation, egg retrieval and freezing.⁶

Ovarian stimulation

- Synthetic hormone preparations are given to stimulate ovaries to produce multiple eggs, rather than the single egg that typically develops monthly.
- Medications to prevent premature ovulation. Injectable gonadotropin-releasing hormone agonist or a gonadotropin-releasing hormone antagonist are given to the woman for prevention of premature ovulation.
- Monitoring: Estrogen levels typically increase as follicles develop, and progesterone levels remain low until after ovulation.
- Follow-up: To monitor the development of fluid-filled sacs where eggs mature (follicles).
- When the follicles are ready for egg retrieval-generally after 10 to 14 days-an injection of human chorionic gonadotropin or another medication can help the eggs mature.

Egg retrieval

- Egg retrieval is done under sedation through transvaginal ultrasound aspiration. A needle is then guided through the vagina and into a follicle. A suction device connected to the needle is used to remove the egg from the follicle. Multiple eggs can be removed, and studies show that the more eggs retrieved-up to 15 per cycle-the better the chances of birth.
- After egg retrieval, a woman might have cramping. Feelings of fullness or pressure might continue for weeks because the ovaries remain enlarged.⁴

Cryopreservation of ovum

Prior to the development of egg vitrification, cryopreservation was done with a method known as slow freezing (or "controlled rate" freezing). During slow freezing, the egg cell is cooled very slowly-at a decrease of .3°-2° Celsius per

minute-until it reaches -196° Celsius. This is done inside a controlled rate freezer filled with liquid nitrogen to allow it to reach very low temperatures.

The problem with slow freezing is that the longer the egg freezing process takes, the more likely it is that ice crystals will form in the egg cell. Ice crystals, which form within the water in a cell, can cause damage to cell structures and make it impossible for the egg to survive and fertilize. This is especially crucial for eggs, which have a higher water content than other cells you might freeze (like sperm).

The vitrification method of egg freezing addresses this key problem. Egg vitrification is a "flash freezing" method in which cells are immersed directly into liquid nitrogen, cooling them so quickly to -196°C that they become "glass-like" or "vitrified." While the slow freezing technique takes hours, vitrification is completed nearly instantly, significantly reducing the chance that ice crystals will form and damage the cell.²

After the procedure

Typically, one can resume normal activities within a week of egg retrieval. Avoid unprotected sex to prevent an unintended pregnancy.

A woman should contact Doctor if-

- A fever higher than 101.5 F (38.6 C)
- Severe abdominal pain
- Weight gain of more than 2 pounds (0.9 kilograms) in 24 hours
- Heavy vaginal bleeding-filling more than two pads an hour
- Difficulty urinating⁷

RESULT

When a woman wants to use her frozen eggs, they'll be thawed, fertilized with sperm in a lab, and implanted in your or a gestational carrier's uterus.

Chances of successful pregnancies with frozen eggs

The chances of becoming pregnant after implantation are roughly 30 to 60 percent, depending on the age at the time of egg freezing. The older the women are at the time of egg freezing, the lower the likelihood that they'll have a live birth in the future.

Research studies related to egg cryopreservation

A retrospective observational study was conducted by Talreja D. *et al* in 2020, where a total 60 oocyte donation cycles were included (38 were fresh and 22 were vitrified oocytes cycle, respectively). After a thorough screening, controlled ovarian hyperstimulation for donors was performed using flexible antagonist protocol. All mature oocytes were allocated into "vitrified oocytes" and "fresh oocytes" groups. Vitrification technique using Cryotop method was used for oocyte freezing. Both clinical and laboratory outcomes of vitrified and fresh oocytes in donor cycles were compared.

They found that a total of 600 oocytes (226 "vitrified oocytes" and 374 fresh oocytes), were studied. After warming 218 oocytes survived resulting in survival rate of 96.4%. Fertilization rate and embryo formation rate was 86.2% and 93.6%, respectively. Results of frozen-thawed oocyte donor

cycles were compared with fresh donation cycles. For fresh oocyte group, fertilization rate and embryo formation rate was 83.4% and 92.6%, respectively. On comparing clinical outcomes, clinical pregnancy rate was 60.5% in fresh group and 63.6% in vitrified group.⁹

CONCLUSION

The newer "vitrification" technique for freezing has further improved the success rates for actual conception than the earlier method of slow freezing. A successful oocyte freezing program can help in establishment of oocyte banks, which would help to provide compatible oocytes immediately, thus would help to eliminate the several problems related to fresh donor cycles.⁹

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