

The Future of Fertility: From Womb Transplant to Ovarian Tissue and Embryo Freezing

Gina Shaw, Brunilda Nazario, MD | March 02, 2015

Fertility doctors don't give standing ovations very often. But when a team of Swedish doctors announced at a recent conference the first-ever birth of a baby to a woman who had a womb transplant, it nearly blew the doors off the room.

"I haven't seen this kind of reaction to a report in all the years that I've been in this field," says Karine Chung, MD, assistant professor of obstetrics and gynecology at the University of Southern California's Keck School of Medicine. "It required a huge amount of hard work and dedication to get to the point where you can transplant a uterus into someone born without one and achieve a live baby."

Only nine women to date have undergone womb transplants, with three live births so far and "some ongoing pregnancies," says Mats Brännström, MD, the doctor leading the trial at Sweden's University of Gothenburg. And ultimately, even when the procedure is more advanced, it will be useful only for a small group of women, mainly those born without a uterus.^[1] That happens to only about 1 in every 5,000 U.S. women.

According to the CDC, some 7.4 million women in the U.S. between the ages of 15 and 44 have at some point sought fertility services. What are some of the other options on the horizon for these women?

Ovarian Tissue Freezing

A woman's biological clock ticks mainly in her ovaries, not her uterus. (The transplanted uterus in Sweden came from a 61-year-old woman.) What if there were a way to keep the ovaries (or at least part of them) frozen at peak-fertility age, perhaps around 29 or 30, and then "wake them up" when a woman was ready to have a child?

In a sense, there is. It's called ovarian tissue cryopreservation (freezing).^[2] Strips of tissue from a woman's ovary — or sometimes one entire ovary — are surgically removed and kept frozen, then transplanted back at the right time.

So far, about 30 successful pregnancies have resulted from ovarian tissue freezing, says Chung. But all of these pregnancies have been in women diagnosed with cancer, who froze the tissue before undergoing chemotherapy or radiation that could damage their fertility.

"It's working relatively well, but it's still considered experimental," Chung says.

Egg Freezing: Game Changer

For the average woman facing a ticking biological clock, the fertility advance that's most likely to make a difference is egg freezing. For years, this procedure was also experimental. Doctors could extract eggs, fertilize them with a partner's sperm, and freeze the resulting embryo with a good chance of success — but freezing an egg alone was harder.

That's because the egg is mostly water, and when one is frozen, "cracking" — damage to the genetic code — can occur during freezing or thawing. A newer method of egg freezing, a super-fast cooling known as vitrification, finally solved that problem. To date, more than 2,000 healthy babies have been born after egg freezing. In 2012, the [American Society for Reproductive Medicine](#) announced that the procedure was no longer experimental.



"This is transformative for women," says Teresa Woodruff, PhD, director of the Women's Health Research Institute at the Northwestern University Feinberg School of Medicine. "It allows women to bank eggs and preserve their fertility without having to worry about a sperm donor, or think about whether they want to commit to having children with the boyfriend they have right now."

Most fertility experts agree that if you're going to freeze eggs, you'll have the best chance of getting a larger number of healthy eggs if you do it before about age 35. In the fall of 2014, Apple and Facebook caused a stir when they announced that they would cover egg freezing as a health benefit for their female employees.

But before you run out to freeze your eggs at 30 "just in case," Chung cautions that there are still unknowns. "Maybe you will never need them, and then you've spent all that money -- one cycle costs about \$10,000, and then it's \$500 per year to store them -- and you have to decide what to do with the eggs you've frozen."

You also can't test the eggs that you're freezing to see if they are chromosomally normal. Embryos can be tested, but eggs can't. Chung says finding a way to test them will be a major development, but that's probably a decade away.

Freezing of embryos, meanwhile, is proving to be an effective technique for helping to ensure a successful pregnancy in some of the thousands of women who undergo standard in vitro fertilization every year. For a pregnancy to be successful, the lining of the uterus needs to be the right thickness when the embryo is implanted.

"When you've just undergone IVF and you have high doses of hormones in your body, your uterus isn't as 'friendly,'" Chung says. "More and more, we're having women go through an IVF cycle, produce embryos, freeze them, and then come back a month later to have the embryo implanted when their hormones are at a more normal level. We're seeing results that suggest that pregnancy outcomes may be better after these frozen transfers, in fact."

What hasn't changed and probably never will is the fact that a woman's fertility declines as she ages, especially after the age of 30, Chung says. "A woman is born with a limited supply of eggs, and no technology has been found to make her regenerate new ones."

On the Horizon: Test-Tube Sperm and Eggs?

Scientists at the University of Cambridge in England recently announced that, for the first time, they've been able to make primordial germ cells -- the primitive cells that ultimately become sperm and egg -- directly from human skin cells, in a laboratory environment. (The research appeared in the journal *Cell*.)^[3] The technique is probably at least 10 years from being ready for prime time. Still, it's an important first step toward being able to make fully mature sex cells in a test tube, which may one day allow infertile couples who can't produce sperm and eggs to have biological children.

References

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