Canadian biotech brings AI to IVF

When it comes down to it, in vitro fertilization has two ingredients: a sperm and an egg. But it isn't quite as easy as "one plus one equals embryo," as there are several points in the process where IVF might fail. Toronto-based Future Fertility is using an artificial intelligence-based tool to objectively measure egg quality and improve the success rate of IVF.

Fertility doctors use visual assessment—their eyes—to evaluate sperm and embryos. For example, semen analysis can turn up abnormal sperm, inactive sperm or a low sperm count. But there is no equivalent to judge eggs.

"It's not like we chose not to have an egg classification system, we just haven't been able to create one," said Dan Nayot, M.D., Future Fertility medical director. "There are several reasons why, but one of the key ones is that eggs look quite similar to each other to the human eye … Unless it looks extremely abnormal, it is difficult to distinguish a good egg from a bad egg."

Future Fertility is using machine learning to see what the human eye can't. And it's possible because of the data that are now available.

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"We are in the era of archived images of eggs, which we didn't have a long time ago. We're in the era where we have really good correlation of outcomes with each egg," Nayot said.

Future Fertility's tool, named Violet, combines machine-learning software with a camera that attaches to a light microscope, a piece of equipment in every IVF lab. Once eggs have been extracted, a doctor will put each one under a microscope. Violet takes a photo and uploads it to the cloud, where Violet runs its assessment. It then prints out a report on that egg. Violet's machine-learning component is trained on data from time-lapse incubators—essentially, videos of fertilized eggs becoming embryos in a special incubator.

"We used thousands and thousands of images of eggs correlated with electronic medical records of what happened to each egg: did it become an embryo? Did it implant?" Nayot said. "We know what happened to every single egg: this one was fertilized, this one became an embryo, this one ended in miscarriage, this one was a live birth. It allows the application of AI to solve the egg-scoring classification riddle."

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Fertility is a particularly good arena for machine learning because the data are clean, with binary outcomes, Nayot said. Other healthcare uses of AI include analyzing pathology or radiology images, but these deal with "a lot of gray zones." With IVF, you're either pregnant, or you're not pregnant. It's an embryo, or it's not, he said.

Violet can predict 90% of the time whether an egg will fertilize, the company says. It can predict about 65% of the time if that fertilized egg will become a blastocyst, the next step before it grows into an embryo. As Violet gets more data from more eggs, its predictions will get better, and it will also be able to make predictions further down the road, Nayot said. This could include predicting whether an egg might become a genetically normal embryo and lead to pregnancy, he said.

"To date, we've gone out and formed partnerships with about seven different clinics from different parts of the world, in Japan, Spain, Canada and the U.S.A.," said Future Fertility CEO James Lanthier. "The purpose of those partnerships has been to get the product—which is currently in the beta phase—into the hands of clinics who are willing to test it and share their data with us."