

Transvaginal Ultrasound-Guided Oocyte Retrieval

Transvaginal ultrasound-guided oocyte retrieval, also known as egg retrieval, is a surgical technique used by medical professionals to extract mature eggs directly from the women's ovaries under the guidance of ultrasound imaging. In 1982, physicians Suzan Lenz and Jørgen Lauritsen at the University of Copenhagen in Copenhagen, Denmark, proposed the technology to improve the egg collection aspect of in vitro fertilization, or IVF. During IVF, a healthcare practitioner must remove mature eggs from a woman's ovaries to fertilize them with sperm outside of the body. Transvaginal ultrasound-guided egg retrieval is a surgery that can be completed in a medical office setting in twenty minutes. Transvaginal ultrasound-guided egg retrieval increased mature egg collection and rates of successful fertilization, becoming the new standard for egg collection in IVF.

Prior to the late 1980s, laparoscopy was the standard surgical procedure used to collect eggs for IVF, requiring the patient to be fully unconscious in a hospital setting. IVF was first successfully used to accomplish human pregnancy in 1978 by medical researchers Robert Edwards and Patrick Steptoe. Healthcare practitioners perform IVF on a woman in a series of steps. First, the patient's healthcare provider typically prescribes the woman some medications that increase the ovaries' egg production. Then, fertility specialists retrieve the mature eggs via a procedure, which was laparoscopy before transvaginal ultrasound-guided oocyte retrieval, after which they fertilize the eggs with sperm outside the woman's body. The fertility specialist then transfers the resulting embryos into the woman's uterus. In order to retrieve the mature eggs for fertilization, Edwards and Steptoe used laparoscopy. For laparoscopic procedures, a surgeon inserts a thin tube with a camera attached to the end into the patient's abdomen via a surgical incision, in which they can use a variety of surgical instruments to extract the eggs. The technique comes with downsides, as the patient must be fully unconscious and there are many risks, including bleeding, infection, and abdominal pain.

As a result of the rising demand for IVF, researchers developed transvaginal ultrasound-guided oocyte retrieval in the late 1980s to resolve some of the technical limitations of laparoscopy. Physicians Lenz and Lauritsen, who worked together at the University of Copenhagen in Copenhagen, Denmark, were some of the first researchers to investigate the use of transvaginal ultrasound-guided oocyte retrieval in 1982. From their preliminary research, Lenz and Lauritsen concluded that the new technique was safer and less expensive than laparoscopy. Then, in 1984, Pierre Delenbach and his colleagues in Strasbourg, France, built upon Lenz and Lauritsen's research by successfully using transvaginal ultrasound-guided oocyte retrieval during five IVF procedures. After several other researchers began utilizing the technology throughout Europe, it became the standard of egg retrieval for IVF towards the late 1980s. A 1987 article published in the Toronto Star details the first implementation of the novel technique at University Hospital in Ontario, Canada. University Hospital's in vitro co-director, Stanley Brown, stated that unless their ultrasound machinery broke down, there was a low chance that laparoscopy would be performed in the context of IVF at the hospital ever again.

As of 2020, transvaginal ultrasound-guided oocyte retrieval is still the standard practice for IVF egg retrieval and is a relatively safe procedure that takes between twenty to thirty minutes. For patients undergoing IVF, egg retrieval begins about thirty-five hours after being injected with a medication used to complete the ovarian stimulation process. To prepare for the procedure, the patient must stop eating or drinking after midnight the night before the procedure in order to avoid inhaling stomach contents during the procedure. On the day of the operation before the actual procedure begins, a healthcare professional administers pain-blocking medication directly into the patient's bloodstream to prevent any discomfort during the procedure. Unlike laparoscopy where

the patient is fully unconscious under general anesthesia, the patient is conscious throughout an entire transvaginal ultrasound-guided oocyte retrieval procedure. Some physicians perceive that as advantageous because surgical procedures using general anesthesia are often associated with increased risks of side effects and increased costs. Some of those side effects include bleeding into the abdomen, injury to surrounding pelvic structures, and infection.

Healthcare professionals conduct transvaginal ultrasound-guided oocyte retrieval in a series of steps, beginning with the patient lying back on a table with both of their legs bent and supported by stirrups. First, the healthcare professional rinses the woman's vagina with sterile water, and then inserts an ultrasound probe into the vagina to visualize the ovaries and fluid-filled egg follicles. During a typical menstrual cycle, follicles within the ovaries house immature eggs while one will typically reach maturity each month. However, during IVF, patients take medications that enable many eggs to mature during one cycle rather than just one. Using the ultrasound probe as guidance, the doctor inserts a thin needle into the patient's vagina, through the vaginal wall, and into the ovary to access the mature eggs. Once inside the ovary, the needle, attached to a suction device, is guided by the doctor into follicles where it gently sucks up follicular fluid containing mature eggs. Physicians only collect mature eggs because immature eggs cannot be fertilized. The patient should feel minimal pain during the procedure, and following the completion of the procedure, they must remain in the clinic for an hour to rest before heading home to fully recover.

Although many patients return to work the day after their procedure, they may experience some side effects. Because transvaginal ultrasound-guided oocyte retrieval is done under the guidance of ultrasound, severe complications are exceedingly rare, but mild side effects such as soreness, cramping, and bleeding are common. Those side effects can occur due to the manipulation of the ovaries and the small punctures used to extract the eggs from the ovaries. Because the ovaries can become enlarged from stimulation, the patient should avoid lifting heavy objects and high intensity exercise like running until the ovaries return to a normal size. According to Lucile Packard Children's Hospital at Stanford University in Palo Alto, California, ovaries typically return to a normal size in about six to ten weeks, or until menstruation occurs if the IVF pregnancy is unsuccessful. Healthcare providers may also recommend that the patient avoids sexual intercourse and hot tubs following the procedure to reduce the risk of infection. Despite those precautions and potential side effects, many physicians utilize transvaginal ultrasound-guided oocyte retrieval over any other methods of retrieval.

Aside from decreased operating room times and expenses, research suggests that transvaginal ultrasound-guided oocyte retrieval is more successful than laparoscopic egg retrieval. Some of the measures of success include higher numbers of retrieved mature eggs and higher fertilization rates, meaning physicians are able to transfer more viable embryos. One study done in 1988 by David Seifer and colleagues at the Cleveland Clinic Foundation in Cleveland, Ohio, directly compared transvaginal ultrasound-guided oocyte retrieval to other methods of egg retrieval like laparoscopy. They found that, in comparison to laparoscopic retrieval, transvaginal ultrasound-guided oocyte retrieval enabled physicians to acquire a higher number of mature eggs based on the visualization of the mature eggs within the ovaries. Laparoscopic methods of egg retrieval have limited visibility, which may increase the likelihood of collecting immature eggs that cannot be used for IVF. Researchers hypothesize that laparoscopic methods of collection may have resulted in lower fertilization rates than transvaginal ultrasound-guided oocyte retrieval. That is because physicians must pump carbon dioxide gas into a patient's abdomen during a laparoscopic procedure, which can potentially harm the eggs. The increased fertilization rates of transvaginal ultrasound-guided oocyte retrieval procedures are not only beneficial to the success of IVF, but further support the technique's usage as IVF's standard method of egg collection.

As of 2020, researchers are studying the effects of three-dimensional ultrasounds to make transvaginal ultrasound-guided oocyte retrieval more accurate and precise. Whereas the previous technology utilized two-dimensional ultrasound waves, the use of three-dimensional ultrasound waves has been shown to provide physicians with a more accurate assessment of the size of follicles. Physicians may also use the three-dimensional technology to enhance early screenings which may guide what medications the doctor may prescribe prior to egg retrieval to make it more successful.

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