Assisted Reproductive Technologies [1]

By: Zhu, Tian Keywords: Reproductive assistance [2] Fertilization [3]

Assisted reproductive technologies (ART) are a collection of different techniques designed to help those who are infertile achieve a successful pregnancy [4]. The most popular technology currently in use is *in vitro* [5] fertilization [6] (IVF), but others include gamete intrafallopian transfer (GIFT), zygote intrafallopian transfer [7] (ZIFT), intrauterine insemination (IUI), and intracytoplasmic sperm injection [8] (ICSI). Although not encompassed under the umbrella term of ART, there are also various hormonal medications that can induce ovulation [9] such as clomiphene citrate [10] that can either be used alone to help women conceive, or used in conjunction with the above techniques. Infertility is a problem that has affected people throughout history, but it was only in the last half of the twentieth century that medical research developed technologies to help those who are infertile become pregnant.

Fertility drugs alone, such as clomiphene citrate [10], are usually tried first if anovulation [11], the lack of ovulation [9], seems to be the only cause of infertility [12]. This technique, if suitable, is the least costly method. Drugs like clomiphene citrate [10] stimulate ovulation [9] by increasing both follicle stimulating hormone [13] (FSH) and luteinizing hormone [14] (LH). The physician first administers the lowest daily dosage of 50 mg to the patient for five days. If ovulation [9] does not occur, the dosage is raised 50 mg at a time until the minimum dosage required to induce ovulation [9] is reached (with a maximum recommended dosage of 250 mg). Once ovulation [9] occurs, the physician instructs the patient to have intercourse every other day for a week. If pregnancy [4] does not result, the physician will try again for four to six treatment cycles before turning to ART.

IUI is considered one of the oldest techniques to treat infertility [12] and dates back to the early 1900s. The current method may include the physician giving the woman fertility medication to induce ovulation [9]. Once ovulation [9] occurs, naturally or aided by drugs, the physician places collected sperm [15] directly into the uterus [16], bypassing the cervical mucus. The sperm [15] is either collected fresh from a partner or donor, or taken from sperm [15] banks. IUI is generally used if a woman has cervical mucus that is hostile to sperm [15] or if the male has a low sperm [15] count, in which case his semen [17] can be removed to concentrate the sperm [15]. Although IUI is a fairly simple and low-cost technique, it is not commonly used now due to the increased availability of other techniques that have much higher successful fertilization [6] rate and live birth rate, such as IVF, GIFT, and ZIFT.

IVF was pioneered in the 1970s by Dr. Robert Edwards [18] and Dr. Patrick Steptoe [19]. As of 2009, it is the most commonly used and most successful technique to help women conceive, especially following the development of ICSI by Dr. Gianpiero D. Palermo [20] in 1993. For IVF, the physician first treats the patient with a fertility medication such as clomiphene citrate [10] to stimulate ovulation [9] of several ova. Once the ova are mature, the physician extracts several of them through transvaginal oocyte retrieval [21]. During this procedure, the physician uses a sonogram to guide a needle through the cervix [22], pierce the vaginal wall, and enter the ovaries to extract the ova. The sperm [15] used in the procedure is obtained either by masturbation, by a collection condom, or surgically through an incision in the testes [23] if a blockage is preventing the normal ejaculation of sperm [15]. Once the egg [24] and sperm [15] are collected, the physician fertilizes a few of the ova using ICSI: using a needle to manually inject one sperm [15] into an ovum [25] to fertilize it. Once successful fertilization [6] takes place and successful cell division occurs, anywhere from one fertilized egg [26] to several are placed into the uterus [16] for implantation [27]. The number of fertilized eggs placed in the uterus [16] depends on a woman's age as well as other factors that may affect the chance of at least one egg [24] implanting. Since often more than one egg [24] is placed in the uterus [16], the likelihood of more than one implanting is also relatively high, bringing the possibility of multiple births.

GIFT is a procedure initially developed by Dr. Ricardo Asch [28] in the 1980s. In this technique the physician extracts the ova and sperm [15] with the same procedures as in IVF, but the ova are not fertilized *in vitro* [5] (outside of the body). Instead, the collected ova and sperm [15] are not mixed until the physician inserts each into the fallopian tubes [29] where they come into contact and allow fertilization [6]. The likelihood of successful fertilization [6] leading to a pregnancy [4] is lower with GIFT than with IVF or ZIFT, but some patients prefer this method because it costs less and is considered a more "natural" method since fertilization [6] occurs inside the body as it would normally.

Zygote intrafallopian transfer (ZIFT) is a combination of IVF and GIFT. The sperm [15] and ova are extracted with the same procedures as IVF and GIFT, and the ova are fertilized outside of the body as with IVF. ICSI may also be used in conjunction with ZIFT. During a ZIFT procedure, the developing embryo is placed in the fallopian tubes [29] at the zygote [30] stage (in contrast to IVF where the developing embryo is placed in the uterus [16] later in its development, at the blastocyst [31] stage). Since the developing embryo is placed in the woman's body much sooner with ZIFT, it is also considered more "natural" than IVF.

Many treatments are currently available to treat infertility [12], and each treatment has improved dramatically since its inception. Adoption is no longer the first option to turn to for those who cannot conceive on their own now that modern technology has

offered them a chance to conceive.

Sources

1. Brody, Steven A., and Robert G. Edwards. Principles and Practice of Assisted Human Reproduction. Philadelphia: W.B. Saunders Company, 1995.
2. Burfoot, Annette, ed. Encyclopedia of Reproductive Technologies. Boulder: Westview Press, 1999.

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Subject
Reproductive Techniques, Assisted [32]

Topic
Technologies [33] Reproduction [34]

Publisher
Arizona State University. School of Life Sciences. Center for Biology and Society. Embryo Project Encyclopedia.

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Format
Articles [35]

Last Modified
Wednesday, July 4, 2018 - 04:40

DC Date Accessioned
Thursday, May 10, 2012 - 14:01

DC Date Available
Thursday, May 10, 2012 - 14:01

DC Date Created
2009-07-22

DC Date Created Standard
Wednesday, July 22, 2009 - 07:00

- The Embryo Project at Arizona State University, 1711 South Rural Road, Tempe Arizona 85287, United States

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