

What are the assisted reproductive technologies for male infertility?

Indications for IVF/ICSI/IUI, Surgical sperm retrieval techniques

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Male fertility problems can occur when sperm are limited in number or function. In some cases, sperm washing is used to concentrate spermatozoa and deliver them through the uterus at the time of ovulation. In order for this treatment (referred to as intrauterine insemination [IUI]) to be successful, typically 5 million motile sperm must be present in the ejaculate. A more advanced technique for enhancing the interaction of sperm and egg is in vitro fertilization (IVF). IVF is an involved process that includes treatment of the woman using a series of hormone injections to stimulate the ovaries to produce multiple eggs, egg retrieval, and fertilization of those eggs outside of the body. A limited number of the fertilized eggs (embryos) are then transferred back to the woman's uterus after incubating in the laboratory for several days. It was initially recognized that impaired sperm would not fertilize eggs very efficiently, even when sperm are put directly next to the eggs in the laboratory. Indeed, it was recognized early on in IVF that if sperm were abnormal, then IVF was not very successful. Conditions where very impaired sperm are present include men who have very few sperm in the ejaculate, when motility of sperm is severely impaired, or the shape of the sperm was very abnormal. All of these conditions may be present for men with severely impaired sperm production. When there is severe deficiency of sperm number and/or limited ability of the sperm to fertilize during IVF, then the adjunctive treatment of intracytoplasmic sperm injection (ICSI) may be required to provide any reasonable chance of pregnancy to occur for these patients.

The solution of ICSI to enhance the ability of impaired sperm to fertilize an egg was identified in 1991 by Drs. Gianpiero Palermo and Andre Van Steirteghem in Belgium. During an attempt to place a sperm close to an egg, Dr. Palermo accidentally injected a spermatozoon directly into an egg. The injected egg fertilized, developed into an embryo, was transferred back to the woman's uterus and resulted in a pregnancy with delivery of a normal, healthy child. With this "accident," a revolution in fertility treatment (especially the treatment of men with severe fertility problems) was started. Subsequently, ICSI has been used to expand the spectrum of male-factor infertility cases that can be treated for infertility. Whereas sperm from the testis or epididymis were thought to be incapable of fertilization, ICSI has changed our view of the fertilizing ability of "immature" sperm retrieved from the male reproductive tract.

Currently, not only are sperm of limited number (oligozoospermia), severely impaired motility (asthenozoospermia), and sperm that are not normally shaped (teratozoospermia) possible to use for ICSI, but sperm taken from the epididymis or testis that have not passed through the male reproductive system can also be used for ICSI. The development of ICSI encouraged us to search more extensively for sperm in the testes, not only for men who have reproductive tract obstruction, but also for men with sperm production so poor that no sperm are present in the ejaculate (azoospermia).

In order to perform the single-sperm injection technique (ICSI), in vitro fertilization is necessary. In vitro fertilization involves the stimulation of a woman's egg production in a controlled manner so that multiple eggs are produced in the given month or "cycle" of treatment, rather than the usual one egg per month. Initial treatment with medications to suppress a woman's natural control of ovulation is given, followed by a series of hormone injections over a 3-4 week period of FSH-like fertility drugs. The final ten days or so of hormonal stimulation requires close monitoring of the woman's response to these drugs with daily serial ultrasound and blood tests. When optimal development of the eggs is seen, based on the development of follicles (fluid containing structures on the ovaries) and increased female hormone levels, then a final priming injection of a natural hormone (hCG), mimicking the physiological "LH-surge" that occurs before ovulation, is given to stimulate final egg development. Eggs are retrieved using a needle, directed by ultrasound through the vagina into these follicles, under a light general ("twilight") anesthetic. Sperm may then be injected into the eggs (oocytes) outside of the body ("in vitro").

The fertilized oocytes (now embryos) are maintained in culture for 3-5 days before transfer back to the woman. The chance of an individual embryo implanting and developing into a fetus is limited to 20-50%, depending on how well the embryo developed prior to transfer. Overall, the chance of pregnancy for each IVF attempt varies based on the age of the female partner. The chance of delivering a child for an individual IVF attempt from initial stimulation of egg production averages about 30%, but the chance of pregnancy when a woman is over 40 years of age may drop to about 10%.

Since the sperm that are selected for IVF and ICSI would not have naturally fertilized eggs in the past, concern exists about the risk of potential birth defects after application of IVF/ICSI (Chapter 23). To-date, the risk of birth defects does not appear to be any higher with sperm selection during ICSI, although a small but statistically significant increase in chromosomal abnormalities occurs after ICSI. The increase of chromosomal abnormalities in children from 0.2 to 0.8% with ICSI may occur because of abnormalities in the man providing sperm or the ICSI procedure itself.

The development of the advanced reproductive techniques of IVF and ICSI have revolutionized the treatment of severe male infertility. Many men are now

routinely treated using IVF/ICSI who would not have naturally fathered children before. Many doctors believe that specific treatment of male abnormalities make these advanced reproductive treatments unnecessary, because natural pregnancy can occur if improved sperm production can be obtained. ICSI has allowed new groups of men to be treated, including men who require sperm retrieval because of a lack of sperm in the ejaculate. The outcomes of these treatments continue to be studied.

Suggested reading

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