

# Intracytoplasmic Sperm Injection

Intracytoplasmic Sperm Injection (ICSI) is an assisted reproductive technique (ART) initially developed by Dr. Gianpiero D. Palermo in 1993 to treat male infertility. It is most commonly used in conjunction with in vitro fertilization (IVF) or a less commonly used technique called zygote intrafallopian transfer (ZIFT). In natural fertilization, the sperm must penetrate the surface of the female egg, or oocyte. When the male has a fertility problem such as low sperm count, malformed sperm shape, or sperm immobility, there is a significant decrease in the chance a healthy sperm will penetrate the outer surface of the oocyte. Other fertility problems ICSI can be used to overcome include the sperm having trouble attaching to the egg or the male having a blockage in his reproductive tract preventing normal ejaculation. In this procedure, the physician first obtains the sperm and oocytes from the male and female and then manually injects the sperm through a needle into the oocyte to fertilize it in an injection plate. The physician then places the fertilized egg into the female's uterus for implantation, following IVF or ZIFT procedures.

Physicians obtain sperm by the same methods as with IVF: either through masturbation, by using a collection condom, or by surgically removing sperm from a testicle through a small incision. The females are treated with fertility medications for approximately two weeks prior to oocyte retrieval to stimulate superovulation, where the ovaries produce multiple oocytes rather than the normal one oocyte. The oocytes are retrieved by either laparoscopy, or more commonly, transvaginal oocyte retrieval. In the latter procedure, the physician inserts a thin needle through the cervix, guided by a sonogram and pierces the vaginal wall and then the ovaries to extract several mature ova.

Before the physician can inject the sperm into the oocyte, the physician must prepare the sperm by washing and exposing it to various chemicals to slow the sperm movement and prevent it from sticking to the injection plate. Physicians treat the oocytes with hyaluronidase to single out the oocyte ready for fertilization by the presence of the first polar body. The physician then injects one prepared sperm into an oocyte with a thin needle. Often, physicians will fertilize several eggs so they can implant more than one into the uterus and increase the chance of at least one successful pregnancy. This also allows them to save extra embryos, using cryopreservation, in case later IVF rounds are needed. After the physician manually fertilizes the oocytes, they incubate for sixteen to eighteen hours and develop into a pronucleate egg (a successfully fertilized egg about to divide into an embryo). The egg then grows for one to five days in the laboratory before the physician places it in the female's uterus for implantation.

Some problems may occur after injecting the oocyte with a sperm. The needle can possibly damage the oocyte upon penetration; the oocyte may stop dividing into an embryo at some point; or once the fertilized oocyte has reached the embryo stage, the embryo may stop growing. Despite these possible problems, the chance of fertilization increases dramatically with ICSI compared to simply mixing the oocytes and sperm in a Petri dish and waiting for fertilization to occur unaided. Studies have shown that successful fertilizations occur 50% to 80% of the time.

Since the introduction of ICSI, Intrauterine Insemination (IUI) has decreased in popularity by 80%. IUI is another technique used to combat male infertility. One approach is to concentrate the amount of sperm in the semen by removing some of the seminal plasma, the liquid portion of the semen. Another strategy in IUI is to treat the sperm with drugs to improve motility. With ICSI, it is possible to be more selective and choose specific sperm according to their sex chromosomes and possibly other genetic factors, allowing the opportunity to choose the healthiest sperm and thereby eliminate significant genetic disorders. ICSI has greatly advanced male infertility treatment and increased successful fertilizations and pregnancies when IVF alone was previously ineffective. Because ICSI

adds very few risks of any possible birth defects, it has become a widely used technique to help many become pregnant when all other options have failed.

## Sources

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