

INTRACYTOPLASMIC SPERM INJECTION (ICSI) FACT SHEET

Background

In conventional IVF, successful fertilization depends on the sperm's ability to bind to and penetrate the eggs. Until the advent of ICSI, couples in which the male produced few or imperfect sperm had little hope that IVF would benefit them. However, in 1992, a Belgian team successfully obtained fertilization by injecting a single sperm into each of the eggs or "oocytes". The success of this procedure has allowed men with rare sperm or with poorly functioning sperm to produce in vitro embryos with their partner's eggs. Even men who have sperm only in the testicle, such as after vasectomy or congenital absence of the vas deferens, can now use their own sperm to have a child.

In addition, ICSI is now used in cases where abnormal oocytes are recovered that may not allow sperm to penetrate the zona pellucida. ICSI is also utilized in patients that have had poor (< 50%) normal fertilization rates or abnormally high rates of "polyspermic" fertilization (penetration by more than one sperm) following conventional IVF.

ICSI is performed shortly after oocyte retrieval when the oocytes are at the proper stage of maturation for fertilization. On occasion, fertilization unexpectedly fails in conventional IVF and a "Rescue ICSI" is performed the day following egg retrieval. This rarely results in normal embryos because the genetic and cytoplasmic material of the oocytes is aged. Consequently, a proper and thorough evaluation of the male partner before the IVF cycle allows us to identify in advance those cases in which ICSI is advisable. ICSI can benefit nearly all men with abnormal sperm. But, some sperm result in very poor or absent fertilization even after ICSI. Once the sperm enters the oocyte, it must communicate with the oocyte to initiate the process of fertilization and embryo formation ("activation"). Presumably, some men have sperm that are unable to perform this function and fertilization does not occur. The details of the process of oocyte activation are still being elucidated.

ICSI Process

Just prior to oocyte retrieval, the sperm sample is collected and processed to produce a clean preparation of viable sperm. Prior to the ICSI procedure itself, enzymes are used to remove the granulosa cells that surround the oocyte at the time of retrieval. The mature oocytes are then selected for ICSI. Under most circumstances, 65-75% of oocytes are considered mature. Shortly after oocyte retrieval, the embryology staff selects a single sperm from the preparation using a microscopic pipette. The pipette has a needle like tip that is used to pierce the zona and egg membrane. A small amount of egg cytoplasm is aspirated into the micropipette allowing the sperm to mix with the cytoplasmic material. The cytoplasm, now containing the sperm, is replaced into the oocyte. The procedure requires the use of a "micromanipulator", a device that carefully modulates the tiniest movements of the micropipette. Immediately after micromanipulation, each oocyte is returned to the incubator for about 18 hours. The next day, the embryologist inspects the oocytes and determines which have fertilized successfully. The fertilized egg ("zygote") is identified by the appearance of two "pronuclei" within the egg (2PN). The zygotes further incubate for 2-6 days during which cell division takes place producing embryos.

Alternatives to ICSI

ICSI is indicated in couples where sperm are deficient in number or function. Alternative treatments for this condition include: 1) conventional IVF insemination of some or all eggs without micromanipulation, 2) the use of donor sperm either by insemination or IVF treatment, 3) adoption, or 4) no treatment and remaining child free by choice.

Risks and Complications

At times, a man is unable to produce a semen specimen on the day of retrieval. If you cannot be certain that you will be able to provide a semen sample, we ask that you notify us well in advance of the retrieval day. We will arrange for you to cryopreserve (freeze) a sample before your IVF cycle. Alternatively, you can choose to use donor sperm as a back-up or we can aspirate sperm directly from the testicle using a technique known as non-surgical sperm aspiration (NSA). Sometimes, an adequate number of sperm cannot be obtained either from the ejaculate or the testicular aspiration on the day of the oocyte retrieval. If you have very rare sperm then we suggest that you select a sperm donor in advance of the cycle as a backup (see the Donor Sperm Fact Sheet).

The risks from egg micromanipulation include trauma to the oocyte leading to non-viability (death of the oocyte), or other unanticipated/unidentified risks. This trauma can occur during the enzymatic removal of the granulosa cells or the ICSI procedure itself. ICSI does not guarantee fertilization of an oocyte. The probability of fertilization of any oocyte is the same as for oocytes inseminated with normal sperm. The average fertilization rate of oocytes with conventional IVF and ICSI is about 65-70%.

Some men have abnormal sperm or low sperm production because they have a genetic defect such as a small deletion of genetic material from the



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Y chromosome. Performing ICSI for men with one of these genetic abnormalities may result in male offspring with the same fertility disorder. Men most likely to have these genetic disorders are those with sperm concentrations below 5 million per cc. In this circumstance, we recommend genetic counseling before treatment with IVF/ICSI.

We cannot guarantee that any babies born from IVF with ICSI will be normal. A pregnancy conceived naturally carries about a 4% risk that it will have a birth defect. Assisted reproduction, including cycles with ICSI, may increase the risk of birth defects according to some studies while many others found no increased risk of birth defects. A recent study of the long-term development of babies born after ICSI found no increase in defects up to 10 years after the procedure.