A Complete Guide to understanding IUI (intrauterine insemination) and artificial insemination
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- The IUI procedure
- Who should consider an IUI
- IUI success rates
- IUI cost
- What to consider if IUI is unsuccessful

The IUI procedure:

Artificial insemination (AI) is a procedure in which sperm is placed directly into a woman's reproductive tract using means other than sexual intercourse in an attempt to aid in fertility. The sperm source for artificial insemination can be the woman's husband (AIH) or a sperm donor (AID). The sperm can be placed into the vaginal tract (lowest effectiveness), the cervix of the uterus (intra-cervical insemination, improved success compared to vaginal insemination) or the uterine cavity (intrauterine insemination, yielding the highest success rates for AI) using an instrument such as a thin catheter.

IUI, or intrauterine insemination, is a common fertility procedure that is most often performed in an infertility office's examination room. The IUI procedure generally has low risk, does not hurt, and can dramatically improve a couple's chances for conception. The patient having the IUI procedure often describes the procedure as "like a pap smear."

- The IUI procedure must be performed around the time of a woman's ovulation (release of a mature egg from the ovary) in order to result in a pregnancy.
- The IUI procedure requires living motile sperm in order to achieve a pregnancy.
- The sperm sample must be washed prior to IUI.
- A thin sterile flexible catheter can be used to place the washed sperm sample within the uterine cavity during IUI.
- There are some rare risks associated with IUI.
The IUI procedure must be performed around the time of a woman’s ovulation (release of a mature egg from the ovary) in order to result in a pregnancy. Most sperm are thought to live for several days within the uterine cavity and fallopian tubes, so the IUI procedure can be performed up to a few days prior to ovulation for best results. The mature egg that is released at ovulation is thought to be capable of fertilization for 1 or possibly 2 days after it is released, so the IUI procedure can also be performed within a day or so after ovulation with good success.

Determining the time of ovulation is sometimes tricky. The menstrual cycle history can suggest when ovulation most likely will occur since ovulation most often takes place 12-14 days prior to the onset of the next menstrual flow. If a woman has highly regular menstrual cycle intervals every 28 days then she would generally ovulate between cycle days 14 and 16, where cycle day 1 is the onset of heavy bleeding. Further precision can be obtained with some additional testing.
Ovulation predictor kits most often check a woman’s urine using color sensitive tests for Luteinizing Hormone (LH) and the color changes (usually darkens) when there are higher concentrations of LH. During the menstrual cycle, ovulation is normally triggered hormonally by the LH surge, which is a rapid increase in LH concentration that starts to rise about 36 hours (1½ days) prior to ovulation. Therefore, we suggest timing IUIs on the day that the ovulation predictor kit turns positive (suggests the LH surge) or within the next two days.

Serial ultrasound examinations can add even more precision since they follow the maturation of eggs by monitoring the development of ovarian follicles (ovarian cysts that contain an egg). Normally, at the onset of a menstrual cycle there are several small follicles (each containing an immature egg) that begin to grow and mature. Ultrasound exams can follow their development and when the follicle is 16mm or greater in diameter it generally contains a mature egg that can be triggered to ovulate. A woman will eventually trigger her own ovulation naturally with the LH surge but infertility specialists can also trigger ovulation with the injection of a
medication (usually human chorionic gonadotropin or hCG) to more predictably (and accurately) time procedures such as IUI or IVF.

(Ultrasound above with a small ovarian follicle measuring 8mm diameter, which contains an immature egg, at the beginning of a menstrual cycle)

(Ultrasound above with a mid-size ovarian follicle measuring 14 x 15mm in diameter, which contains a mature egg about 80% of the time)
Blood work for estradiol, LH and progesterone concentrations 1-2 times a week can provide additional information. Blood work is most useful to confirm the accuracy of other ovulation tests. Blood work is rarely used by itself to time artificial insemination or IUI since it is easy to miss the LH surge when blood work is done only once or twice a week. Blood work is sometimes useful when a woman’s menstrual cycle intervals are highly irregular (for example every 1-2 months) in order to detect when a follicle is growing more actively (the estradiol will begin to rise sharply) and then ultrasound examinations can be used to precisely time when the follicle is mature and medication can be given to trigger ovulation.

2: The IUI procedure requires living motile sperm in order to achieve a pregnancy.

A common guideline is that at least one million motile sperm are required, and at least 5-10 million motile sperm are ideal, for good success rates with IUI. However, from personal experience, I can recall several patients with total motile sperm counts of much less than one million at IUI who successfully achieved a pregnancy. Only one sperm actually fertilizes the mature egg, but in order to increase the chances of delivering motile sperm to the mature egg within the fallopian tube many sperm are placed within the woman’s reproductive tract. My impression is that the success rates with IUI using very low motile sperm counts are indeed significantly lower than the success rates with IUI using higher motile sperm counts, which is consistent with these common guidelines. But, in the event that the husband has a very low motile sperm count and the couple feels strongly that they would prefer a child with the husband’s sperm rather than donor sperm, I will offer IUI as an entry level treatment option as long as the couple understands that the success rates are significantly decreased. If these IUIs are successful, then that is great. If these IUIs are unsuccessful after a few cycles, then different, more expensive, and more complex procedures are always available for consideration.
The method of collection (and delivery to the lab) for the sperm sample is important in order to increase the yield of motile sperm. The sample is ideally collected by manual masturbation into a clean, warm, plastic container (with a wide opening to limit the loss of sample material during collection) that is properly labeled (first and last name ideally along with a second personal identifier such as date of birth or social security number). The lid should be properly secured and if the specimen is collected anywhere other than within the infertility office then the container should be insulated to prevent heat loss. Sperm is highly sensitive to small temperature changes and if the sample gets either cold or hot the motility of the sperm can be severely compromised. I suggest wrapping the entire specimen container with aluminum foil two times (twice) to limit heat loss, placing the foil wrapped container in a sock to further insulate it, and delivering this insulated container to the office for processing as soon as possible. When wrapped in this way, the specimens delivered to my lab have been of very high quality even when collected several hours prior to arrival at the lab. Maintaining the proper temperature by limiting heat loss seems to be very important.

![Image of a clean specimen cup properly labeled with the patient’s name and date of birth is wrapped with two layers of aluminum foil, for insulation during transportation to the laboratory.]

Generally, 2-5 days of sexual abstinence is suggested in order to obtain the best quality sperm but this is not an absolute rule. For example, when IUIs are performed on consecutive days the sperm sample collected for the second day of IUI is quite often of better quality than the sperm sample from the first day. Additionally, the available literature suggests that more than one hundred million sperm can be produced per day. Therefore, when available, I prefer sperm samples that are collected after a few days of abstinence but I also do not hesitate to use good quality samples that are collected after shorter periods of abstinence.

3: The sperm must be washed prior to IUI.
Sperm must always be washed free of semen prior to IUI since the semen contains prostaglandins. Prostaglandins are molecules that would cause extremely painful uterine contractions for several minutes to a few hours if placed directly into the uterine cavity. Semen also contains oxygen reactive species of molecules that might limit the ability of the sperm to fertilize the egg.

Sperm is normally released within a gelatinous fluid called semen, this semen quickly becomes less viscous (thick), and within 15-30 minutes this fluid usually becomes a thin liquid. Once the semen has thinned out (that is, liquefaction has occurred) the sperm can be separated from the semen using a variety of washing procedures within the laboratory.

(Unwashed sperm sample from patient “A” that shows the sperm having some difficulty moving through viscous gelatinous semen. This sample was washed and the results are shown in the next video. Double click on lower left icon to play video)

A relatively simple but highly effective wash procedure involves a few steps: mixing the whole semen sample that was collected with a warm inert buffered medium such as human tubal fluid (fluid collected from fallopian tubes that contains molecules that help to activate sperm to prepare them for fertilizing an egg); centrifuging this mixed sample to pellet the sperm cells at the bottom of the tube; removing and discarding the liquid (semen and medium) from the tube while preserving the sperm pellet at the bottom of the tube; re-suspending the sperm pellet in additional warm inert buffered medium; centrifuging the sample once again to pellet the sperm; removing and discarding the liquid (remaining semen and buffered medium) while preserving the sperm pellet at the bottom of the centrifuge tube; and re-suspending this sperm pellet in additional inert buffered media.
The washed sperm sample from patient “A “ that shows the improvement in forward progression and movement of the sperm compared to the unwashed specimen in the prior video. Double click on lower left icon to play video

The sperm sample should be analyzed for volume, sperm concentration, sperm motility, and sperm morphology (shape) prior to and following the washing procedure to determine initial quality and yield after wash. Ideally, at least five million motile sperm will be available after the wash procedure for the IUI.

4: A thin sterile flexible catheter can be used to place the washed sperm sample within the uterine cavity during IUI.

Normally a thin flexible plastic catheter can be used to deliver the sperm into the uterine cavity without causing any significant discomfort to the patient. A speculum is used to identify the cervical opening to the uterus, a catheter is attached to a syringe that contains the sperm sample, the catheter is bent slightly to accommodate the angle of the cervical uterine junction, the catheter is inserted into the uterine cavity, and the sperm is slowly injected into the uterus. After the IUI procedure is completed, the woman is asked to lie comfortably on the exam table for about 5 minutes prior to returning to her usual activities.

5: There are some rare risks associated with IUI.

Whenever an instrument, including a catheter, is placed within the uterine cavity there is a chance of inadvertent damage to the uterine lining or perforation through the uterine wall. Historically, metal catheters were used for IUI and these risks were more significant. Nowadays, a flexible and soft catheter is generally used so these risks are minimal. For example, I have always used the soft sterile catheters and I have never personally had a complication with IUI (in several thousand IUIs).
There is a risk of introducing foreign material into the uterine cavity along with the sperm. Semen, which contains prostaglandins and other molecules that should not be placed directly into the uterine cavity, can be inadvertently inserted during IUI if the sample was not thoroughly washed. This could result in painful contractions after IUI or reduced fertility. Also, some infertility clinics mix chemicals with the inert buffered wash media in an attempt to improve the performance of the sperm, but many of these chemicals are relatively new to this process and they can affect the sperm or the resulting fertilized egg in an unanticipated and negative way. My practice does not use any of these additives in order to limit potential unforeseen complications. If the husband or sperm donor has a dangerous viral infection such as HIV or Hepatitis, then the wife may be more likely to get this infection from a washed sperm sample containing very small amounts of virus when it is placed directly into the uterine cavity as compared to the placement of whole semen (with sperm and larger amounts of virus) directly into the vaginal vault during intercourse. Medical researchers recently identified this risk so my office now strongly suggests that the husband is tested for HIV, Hepatitis B and Hepatitis C prior to an IUI that uses his sperm. All sperm donors are routinely tested for these viruses before the sperm is released for IUI.

**Who should consider an IUI?**

IUI (intrauterine insemination) can increase pregnancy rates for many infertile couples.

At our office, when a couple is having difficulty conceiving, I generally suggest a basic diagnostic infertility evaluation to attempt to identify abnormalities. This entry level evaluation normally includes tests related to ovulation (a complete menstrual history, a complete medical history, and blood work for hormone imbalances that might affect ovulation), male factors (a complete medical history, a complete reproductive history, and a semen analysis), and pelvic factors (a hysterosalpingogram, or HSG, to assess the uterine cavity and patency of the fallopian tubes and a postcoital test to assess the interaction of the sperm and the cervical mucus). Based on these results, IUI may be suggested, possibly along with other treatments.

1: IUI often improves pregnancy rates when performed after ovulation induction with medication.

When a woman has an adequate number of eggs within her ovaries and fertility is desired but she is anovulatory (she does not make mature eggs) or oligo-ovulatory (she matures much fewer eggs per year than normal), an oral medication containing clomiphene citrate (Clomid, Serophene) is often used for ovulation induction. When this medication is used, the cervical mucus that is normally abundant and friendly to sperm just prior to the time of ovulation often becomes "hostile" to sperm. Hostile cervical mucus shortens sperm survival within the female reproductive tract and
can prevent the sperm from passing through the mucus to reach the egg (within the fallopian tube). In ovulation induction cycles using clomiphene citrate, IUI is often useful in delivering sperm above the cervical mucus and closer to the fallopian tubes at ovulation.

(Closmithine citrate is usually a small scored pill)

When clomiphene citrate fails to induce ovulation in an anovulatory woman, injectable medications (gonadotropins or menotropins) have a very high success rate (greater than 90%) for ovulation induction. Injectable medications are very expensive compared to clomiphene citrate and they have some additional complications. Research shows that when these injectable medications are used for ovulation induction, IUI increases success rates for pregnancy.

(Injectable medications containing gonadotropins often need to be mixed prior to use. Instructions are provided at the office)
(Most of the highly purified monotropin and gonadotropin medications available require the use of the shorter thinner needle, 27-29 gauge and ½ inch long)

2: IUI can improve success rates for pregnancy if there is a male factor.

Sperm is deposited into the vaginal vault during intercourse and the ejaculate normally contains greater than 40 million sperm. The vaginal vault is characteristically acidic in nature and sperm can only survive in this environment for a short time (less than an hour). In order to fertilize the egg within the fallopian tube around the time of ovulation, motile (moving) sperm normally live comfortably in the slightly alkaline mucus of the cervix for 2-4 days (or longer) and migrate through the uterine cavity to the fallopian tube. Of the greater than 40 million sperm released into the vaginal vault at intercourse, less than 1 million sperm normally make it into the cervical mucus and only a few thousand sperm usually make it up to the fallopian tubes.

IUI with washed sperm generally delivers greater than 1 million sperm directly within the uterine cavity next to the fallopian tubes. Therefore, IUI often improves the ability of sperm to reach the fallopian tubes, where fertilization of the egg can take place, when compared to intercourse.

When an apparent male factor is discovered on semen analysis, fertility treatment options include IUI (ideal for mild to moderate reductions in sperm quality but will occasionally also be successful for severe abnormalities), assisted fertilization requiring IVF (in vitro fertilization) and ICSI (intracytoplasmic sperm injection), and the use of donor sperm (when there is a complete absence of sperm or for severe abnormalities when IVF and ICSI are not available options).

IVF with ICSI is generally very expensive, involves about 2-3 weeks of frequent (sometimes daily) monitoring with blood work and ultrasound exams, and can be highly stressful. On the other hand, IVF with ICSI is usually more successful (in terms of pregnancy rate per cycle of treatment) than IUI.
The use of donor sperm usually involves IUI for placement into the female reproductive tract and requires that the couple carefully consider whether they are comfortable with the use of sperm from a genetically unrelated anonymous male.

3: IUI can improve pregnancy success rates if there is hostile cervical mucus (including anti sperm antibodies).

For normal fertility, sperm must be able to survive comfortably for a couple of days within the cervical mucus. I often suggest a postcoital test (to assess sperm-mucus interaction) just prior to ovulation (when the mucus is friendliest to sperm).

The cervical mucus can become abnormally acidic and this change in pH can severely limit sperm survival. If there is a problem with sperm survival in the mucus then I suggest IUI to place the sperm above the mucus at ovulation. Also, if I find the sperm moving in place (only moving back and forth), as if caught on something within the mucus (usually thought to be due to anti sperm antibodies that attach the sperm to the mucus), then I suggest IUI since these sperm cannot migrate through the uterus to reach the egg in the fallopian tube.

4: IUI can deliver the sperm into the uterus at ovulation when intercourse is not possible.

For a variety of reasons, intercourse may not be possible and sperm cannot be delivered into the female reproductive tract. If this cannot be remedied, then IUI can deliver the sperm into the uterus at ovulation.

(Sperm moving in place with very little forward progression, a characteristic of sperm with anti sperm antibodies attached to them. . Double click on lower left icon to play video)
IUI can be tried for a few cycles to see if a pregnancy results in couples that do not want to undergo diagnostic testing right away.

Sometimes a couple wants to consider a few cycles of IUI as a low risk and low cost infertility procedure that might improve success rates, prior to any formal diagnostic testing. Couples with no medical insurance often consider this since the out of pocket cost of testing can be significant. In these situations, I discuss the risks and potential benefits of IUI with and without prior diagnostic testing, and if the couple still wants to proceed with a few IUIs without testing then I generally comply.

IUI success rates

IUI success rates vary, largely depending on the reason that they are being performed. A more complete discussion of the reasons for considering an IUI is contained in a different section of this Complete Guide to Understanding IUI.

When IUI is performed during cycles using ovulation induction medication, several mature eggs may be released at ovulation and the success rates are somewhat greater than during a natural cycle. The success rate for medicated cycles with IUI may be as high as 30% per cycle.

When IUI is performed for abnormal sperm quality, the placement of sperm directly into the uterus next to the fallopian tubes often improves the sperm’s ability to fertilize an egg. Success rates depend on the severity of the male factor, but may be as high as a normal fertile couple, which is about 20-25% per cycle.

When IUI is performed for hostile cervical mucus, the delivery of sperm above the cervix into the uterus at ovulation should completely avoid the cervical mucus. If the mucus is the only fertility issue for the couple, then they should have a success rate similar to a normal fertile couple (20-25% per cycle).

When IUI is performed for couples that cannot complete sexual intercourse, the success rate should be that of a normal fertile couple (about 20-25% per cycle) if there are no other fertility issues.

When IUI is performed for infertile couples with no formal fertility testing it is impossible to predict success rates since no specific abnormality has been identified. If the couple has an undiagnosed male factor or an undiagnosed mucus factor as a sole reason for the fertility problem, then the IUI should restore success to the chances as described above.

IUI cost
The cost of the IUI procedure is relatively inexpensive compared to other infertility procedures. For an IUI procedure, the cost is often broken down into the cost for washing the sperm and the cost for performing the intrauterine insemination.

Washing the sperm usually involves mixing the semen sample with an inert buffered media (the cost of the media varies), using sterile test tubes and pipettes (the cost of these disposables varies), and centrifuging the sample at least two different times (the cost involves the time spent by the embryologist or doctor and the cost of acquiring and maintaining the required equipment). Some infertility offices also add supplements to the media that is used for the wash and use highly specialized material to separate the sperm from the semen, each with some additional cost. In my office, I personally wash and prepare each sperm sample for IUI myself so that I can guarantee the quality of the washing procedure. I believe that this is better than entrusting the washing procedure to an employee of the laboratory, no matter how trustworthy that employee is, since I will always know that I double checked every step of the procedure myself. For ongoing patients at my office, I have a charge of 130 dollars for the IUI washing procedure.

The cost for performing the intrauterine insemination of washed sperm involves loading the sample into the syringe with the attached catheter, performing a sterile speculum exam, and delivering the washed sample through the cervix into the uterine cavity. The disposable items generally include the plastic speculum used to visualize the cervix and the catheter (which can be very expensive). For ongoing patients at my office, I charge 200 dollars for the insemination of the washed sample into the uterine cavity. If the patient does not have insurance coverage for the IUI procedure, I provide a discounted rate of 200 dollars to cover both the washing procedure and the intrauterine insemination procedure. These rates are very competitive for New Jersey. I have purposefully not increased my rates for these procedures in over 15 years since IUI is an entry-level procedure that I believe that IUI should be affordable for most couples suffering with infertility.

**What to consider if IUI is unsuccessful**

In couples with a clear indication (benefit) for IUI, I generally recommend trying at least 2-4 cycles of IUI prior to considering more aggressive treatment alternatives. The success rates for IUI are generally around that of a normal fertile couple (about 20-25% per cycle) so more than 4 cycles can also be reasonably considered. At least in New Jersey, most couples that I have met become discouraged and very frustrated after about 2-4 unsuccessful cycles of IUI and start to consider other options.

If a basic infertility evaluation (blood work for ovulation disorders, a semen analysis for male factors, a hysterosalpingogram to confirm a normal uterine cavity and tubal patency, and a postcoital test for sperm-mucus interaction) has been completed and IUIs are suggested but ineffective, then there are usually two main options.
The first option is a pelvic evaluation, including laparoscopy and hysteroscopy to assess and treat any undiagnosed pelvic problems. The basic tests do not identify many possible pelvic factors that are usually repairable with an experience infertility surgeon. The possible pelvic problems that are quite often revealed at pelvic evaluation include endometrial polyps, pelvic adhesions (scar tissue), and endometriosis.

The second option is in vitro fertilization (IVF), which involves taking injectable fertility medications to mature multiple eggs, egg retrieval, fertilization of the retrieved eggs in the laboratory, tissue culture of the fertilized eggs (embryos) for up to 5 days, and transfer of the embryos back into the uterine cavity.

In my experience, IVF seems to be more successful in couples after they have repaired any pelvic pathology with a pelvic evaluation. Therefore, I generally suggest the pelvic evaluation prior to IVF. Additionally, many of my patients become pregnant without the need for IVF once their pelvis is successfully repaired. Therefore, I also generally suggest pelvic evaluation as a good alternative to IVF.