**Sperm donation**: When there is severe male factor infertility, the couple may opt for sperm donation. The sperm donors are usually anonymous and they have to donate in the registered semen banks. They are also screened for infectious viral diseases like HIV/ Hbsag / HCV and the same tests are repeated after 6 months before they release the semen sample.

**Egg donation:**

Egg donation is the process by which a woman donates eggs for purposes of assisted reproduction. It typically involves In-vitro fertilization technology, with the eggs being fertilized in the laboratory; more rarely, unfertilized eggs may be frozen and stored for later use.

It is indicated in

1.Congenital absence of eggs

Turner’s syndrome

Gonadal dysgenesis

2. Acquired reduced egg quantity / quality

3. Oophorectomy (surgical removal of ovaries)

4. Premature menopause(before 40 years)

5. Those who have taken cytotoxic chemotherapy or pelvic radiotherapy for cancers

6. Advanced maternal age

7. Compromised ovarian reserve

8. Others: Diseases of X-sex linkage

Repetitive fertilization or IVF failure

Ovaries inaccessible for egg retrieval

Once you decide to go ahead with egg donation, you have to register in the donor bank who would provide you with an anonymous donor matching your requirements. Neither your identity nor the donor’s identity will be revealed to each other, but you will have access to all the requisite information about the donor.

Donors are usually young (<30 years) and are thoroughly screened according to ICMR guidelines.

Menstrual cycle of the donor and the recepient are matched.

Donor is started on injections for about 8-10 days to grow the eggs and simultaneously the recepient’s uterus is prepared with hormonal tablets.

Once the oocytes are retrieved from the donor, they are injected with the recepient’s husband’s sperms, cultured in the incubator for 3-5 days and later 2 or 3 of the embryos are transferred into the recepient’s womb. Rest are frozen for future use.

Egg donation has a high success rate of about 55-60% and almost an 80– 90% success rate after four repeated treatment cycles.

**Sperm Freezing**:

Sperm can be frozen for future use either in artificial insemination or other fertility treatments, or be donated. Donated sperm has to be stored for six months before it can be used in treatment, in order to screen the donor for infection.

It is indicated in

1. cancer patients as a part of the fertility preservation strategy in those who are scheduled for cytotoxic chemotherapy.

2. Stored as a back up when patients are undergoing fertility treatment especially when they have low counts/ collection problem or deteriorating semen parameters.

3. It is also stored for donation for a period of six months as a part of the donor quarantine for infectious diseases.

After thawing the stored sperms, almost 50% of them do not survive and there is a definite deterioration in the quality of the semen. Depending on the quality of the thawed sample, it can be used either for IUI, IVF or ICSI .

**Embryo Freezing and Frozen embryo transfer:**

Embryo freezing is a process where in the unused embryos are frozen at -180 degrees in liquid nitrogen using a method called vitrification.The embryos are normally stored upto five years subject to periodic renewal of charges. If you wish to continue beyond that period, the centre has to be intimated about it. If you wish to discontinue before five years, again you have to intimate the centre and you have the option of either discarding them or donating them for research or donating them for third party reproduction (as an anonymous donor).

The frozen thawed embryos can be transferred into the uterus either in a natural cycle or in a downregulated cycle.

Natural cycle FET: It can be done if you have ovulatory cycles. Your cycles would me monitored by scans for follicular growth and ovulation and the embryos are transferred at the appropriate time following ovulation.

Downregulated FET: Your natural cycle is suppressed using medications and a period is artificially induced, Followed by hormonal medication to prepare the uterus.Once the lining of the uterus is ready, the embryos are transferred at the appropriate time.

Once the frozen embryos are thawed to room temperature, only about 80-85% of them survive. Upon transferring these embryos the success rate is good as a fresh embryo transfer approximately 50%.

**Oocyte Freezing**

Oocyte freezing or egg freezing is a relatively new treatment where in the ovaries are stimulated with hormonal medications for about 8-10 days, follicular growth is monitored by serial scans and blood tests. Once the follicles are ready, a HCG trigger is given and oocyte retrieval is planned after 36 hrs. These oocytes are vitrified and stored in liquid nitrogen at -180 degrees.

Oocyte freezing may be considered

1. If you are diagnosed with a cancer requiring chemtherapy or radiotherapy which is likely to destroy the ovarian reserve.

2. If you are concerned about your age but are not yet ready to bear children.

Oocytes can be stored upto five years subject to periodic renewal of the freezing charges. If you wish to continue beyond that period, the centre has to be intimated about it. If you wish to discontinue before five years,again you have to intimate the centre and you have the option of either discarding them or donating them for research or donating them for third party reproduction (as an anonymous donor).

Once you decide use the frozen oocytes, your endometrium is prepared with hormones similar to the frozen embryo transfer cycle. The vitrified oocytes are thawed at appropriate time and ICSI is done. The resulting embryos are cultured for 3-5 days and then transferred.

Oocyte freezing is not as efficient as embryo freezing and results in a much lower survival rates than the embryo freezing. The success rates are much less than the fresh or frozen embryo transfer and vary from center to center.

**TESA/PESA/ Micro TESE:**

Many men have had a vasectomy for contraception and then later regretted the decision to become surgically sterilized. There are 3 general options for attempts at further child bearing in such a situation.

1.Vasectomy reversal surgery.

2. Sperm aspiration from the testicle or vas deferens and then use of the ICSI procedure to fertilize eggs from the female partner and then in vitro fertilization and embryo transfer.

3. Donor sperm insemination of the female partner.

Sperm aspiration from the epididymis or testicle is called PESA or TESA , which is then used ICSI and IVF. It is indicated when there is azoospermia (absent sperms on semen analysis). It can be either due to obstruction of the vas / duct or due to testicular failure to produce adequate number of sperms.

Sperm can be aspirated with a needle from the testicle or from the vas deferens (a structure right next to the testicle that also contains sperm). The man is given some drugs to sedate him and some local anesthesia is also used to numb the area. Then a small needle is inserted and sperm is aspirated from either the epididymis or the testicle. There should be no severe pain. The procedure generally takes about 30 minutes.

The different sperm aspiration and extraction procedures have long names and also short names (acronyms):

PESA - Percutaneous Epididymal Sperm Aspiration (can be done in the office)

TESA - Testicular Sperm Aspiration (can be done in the office)

TESE - Testicular Sperm Extraction involves a small incision and snipping off some tissue from inside the testicle - often done in a hospital or free-standing surgicenter.

With a PESA or TESA (after vasectomy) there will usually be thousands to millions of sperm retrieved. Unfortunately, there is not enough sperm obtained to get any reasonable success rate from intrauterine insemination IUI of the female partner.

The sperm should be of sufficient quantity and quality to be able to fertilize the female partner's eggs in the laboratory using a procedure that injects each egg with a single sperm. This process is called intracytoplasmic sperm injection, or ICSI.

After fertilization has been accomplished, in vitro fertilization - IVF culture techniques are used to culture the resulting fertilized eggs for 3 to 5 days before embryo transfer is performed to the female's uterus.

Because multiple eggs are needed to have a good chance for success, the woman must go through ovarian stimulation and then an egg retrieval procedure.

The success rate will depend very much on the IVF live birth success rates of the particular in vitro fertilization laboratory. IVF success rates are also dependent on the age of the female partner - even in these "male factor" cases after vasectomies. It is good and comparable to IVF / ICSI with ejaculated sperms in obstructive azoospermia. But the sperm retrieval rates are about 30-35% in testicular failure and in such cases the success rate of IVF/ICSI is less- about 35-40 %.

**Laparoscopic and hysteroscopic surgeries:** Laparoscopic surgery, also called minimally invasive surgery (MIS), or keyhole surgery, is a modern surgical technique in which operations are performed far from their location through small incisions (usually 0.5–1.5 cm) elsewhere in the body.Many conditions can contribute to infertility, including fibroids, endometriosis, pelvic adhesions (scar tissue in the pelvis) and uterine anomalies such as a uterine septum and adhesions (scar tissue inside the uterus – Asherman’s syndrome). They can be treated by fertility enhancing laparoscopic surgeries.

There are a number of advantages to the patient with laparoscopic surgery versus an open procedure. These include:

1. Reduced bleeding, which reduces the chance of needing a blood transfusion.

2. Smaller incision, which reduces pain and shortens recovery time, as well as resulting in less post-operative scarring.

3. Less pain, leading to less pain medication needed.

4. Although procedure times are usually slightly longer, hospital stay is less, and often with a same day discharge which leads to a faster return to everyday living.

5. Reduced exposure of internal organs to possible external contaminants thereby reduced risk of acquiring infections.

Fertility enhancing laparoscopic surgeries include:

a.Laparoscopic myomectomy for the removal of large fibroids or multiple fibroids

b.Laparoscopic treatment of advanced stage endometriosis

c. Laparoscopic ovarian drilling and chromopertubation

d.Laparoscopic tubal reanastomosis (tubal ligation reversal)

e. Laparoscopic removal of large benign ovarian masses or cysts

f. Diagnostic laparoscopy and chromopertubation

Usually these procedures are combined with hysteroscopy to assess the uterine cavity better.

**ERA (endometrial receptivity assay):**

The ERA Endometrial Receptivity Analysis is a personalized genetic test to diagnose the state of endometrial receptivity in the window of implantation.

An endometrium is receptive when it is ready for the embryo implantation. This occurs around days 19-21 in each menstrual cycle of a fertile woman.. This period of receptivity is what we call the window of implantation.

The lack of synchronisation between the embryo ready to be implanted and endometrial receptivity is one of the causes of recurring implantation failure. This is why it is imperative to assess the endometrium in order to determine the optimal day for embryo transfer.

The ERA test requires an endometrial biopsy that should be carried out on day LH+7 (natural cycle) or day P+5 (HRT cycle). This biopsy is quickly and easily taken by a gynaecologist in their consultation room. After being sent away, the sequencing expression of 236 genes involved in the endometrial receptivity is analysed. An in-house designed computational predictor analyses the data obtained, classifying the endometrium as Receptive or Non-Receptive.

This test has been performed on patients who have had recurring implantation failure with embryos of good morphological quality. This test is recommended for patients with seemingly normal uterus and normal endometrial thickness (≥6 mm), in which no problems are detected.A displaced window of implantation is detected in approximately 25% of these patients.This analysis helps determine the personalised window of implantation, enabling personalized embryo transfer (pET) to be performed on the basis of these results.