INFERTILITY AND RECENT ADVANCEMENTS TO COMBAT IT

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Abstract: **Human reproduction is an important process which is needed in each generation to continue and save the human species. For this fertility is needed in every couple. Fertility means the capacity to reproduce and is expected in both male and female. Infertility has become a challenging situation for the human race. Thus, in order to save the human species, infertility problem needs to be wiped off. This review article includes a short process of reproduction, causes, risk, diagnosis and various advanced treatment to prevent infertility and cure it too. Around 12 previous research reviews were included in the article to give a clear view about the problems of infertility. Fertilization in human is a process by which the female mature egg (ovum) unites with the male sperm in the fimbria of the fallopian tube forming a single cell called zygote. Female only is not responsible for infertility; both male and female play equal role in reproduction .The infertility problems are arising in most of the couples worldwide and it may be due to many risk factors. In india also the numbers of infertile couples are rising. Since the development of various advanced infertility treatment most of the couples are now able to have a child of their own.**

KEYWORDS: **Fertilization, Infertility, IVF, Artificial insemination, ZIFT & GIFT**

INTRODUCTION

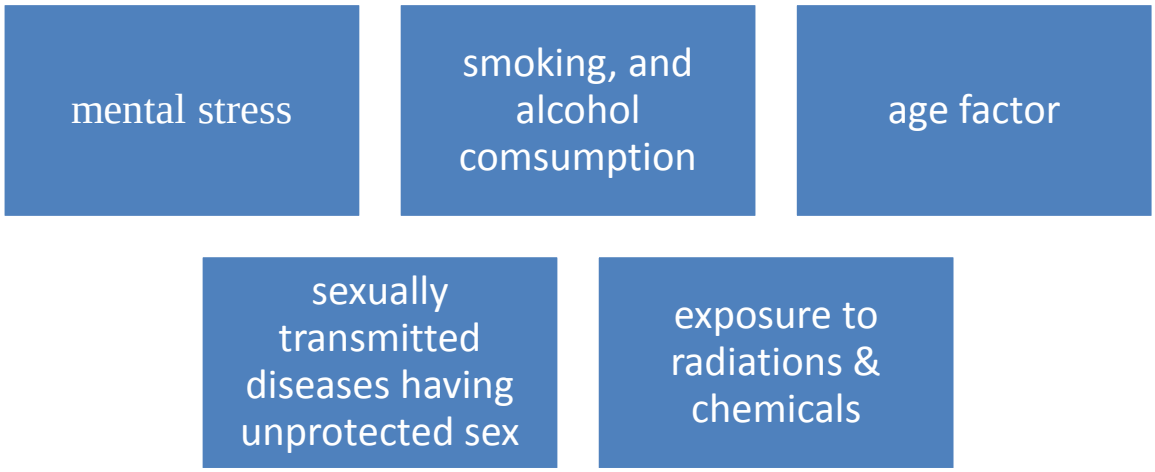
In our society including India, people blame women for being childless in most of the cases which leads to stigma in the life of a woman. To have a child various religious rituals were used in the ancient time and in the modern period also some people still believe in it. In the past it was believed that the past karma is the reason for not having a child in the present birth, so to come out of this situation couples were advised to do rituals like 'putra kameshti yagya' to have a child. In surroundings author has come across five such couples who had problem in bearing child. Their craving for a child could easily be seen in their sad eyes. Their family members made ill comments about them. Even they wanted to remarry the male counterpart. According to the society a women is considered as culprit for not bearing a child. In India the elders think that our generation must continue or their family name will vanish. To have a child especially a male baby of their own blood is considered as the topmost duty of the married couple.

Fertilization (in human) is a process by which the female mature egg (ovum) unites with the male sperm in the fimbria of the fallopian tube forming a single cell diploid zygote. The natural process of fertilization begins when the sperm enters into the female reproductive system during the process of intercourse, it then travels through the uterine cavity and fallopian tube to reach the frimbria where the mature ovum is located. The fusion of sperm and ovum takes place leading to form a fertilized ovum. This fertilized ovum undergoes the binary cell division forming blastomere which changes to morula and lastly the blastocyst stage comes. Initially the blastomere and the morula spend around three days in the fallopian tube and enters into the uterine cavity on the 4^{th} day. On the 5^{th} day formation of the blastocyst occurs and by the 6^{th} day implantation starts. The implantation is mostly complete till 11^{th} day. After this the fetus takes 9 months and 7 days for further development. If this normal process is hindered due to some complication then it may result in infertility. If a women cannot conceive for a period of one year after having unprotected sex, then it is termed as infertility.

The www.geoba.se released a data saying that India ranked 76 in the world total fertilization rate for the current year 2016. Infertility has become a challenging situation for the human race but due to the advancement and progress in the medicine the situation has become better. Infertility occurs in male also. Female only.is not responsible for infertility because both male and female play equal role in reproduction. The infertility problems are arising in most of the couples worldwide and it may be due to many risk factors which are happening in day to day lives of the couples which they are not aware of. In India also the numbers of infertile couples are rising. According to the information published by the express news service Chennai on 27^{th} January 2014 on the topic 'Male and Female Infertility Just Keeps on Rising' says that about 15% of the Indian population both male and female are infertile. According to statistical analysis, the percentage of male infertility has raised to 60 % as compared to 40 % in 1980s [1],

RISK FACTORS & CAUSES

The common risk factors leading to infertility include:



In a recent study by National Institutes of Health (sponsored study) published online in the journal Fertility and Sterility says that both the mother's and the father's **caffeine consumption** affects a couple's chances to miscarry—more than 2 cups a day in the weeks before conception raises risk of pregnancy loss by more than 70%[2]. According to World Health Organization the estimated rate of worldwide infertility during 2010 was 48.5 million. The Mayo Clinic, USA, has estimated about 20% of cases of infertility due to a problem in the man, 40% to 50% of cases of infertility are due to a problem in the woman and about 30% to 40% cases of infertility are due to problems in both the man and the woman. Studies say that the **prolonged usage of pesticides** has increased male infertility in the agricultural sector. Around 500 cases of infertility are seen on monthly basis and every time the complexity of infertility increases. Male infertility is mainly due to intoxication, it could be environmental or their lifestyle habits.

Causes of infertility in female are mainly due to:
1) Ovulation disorder which may be due to-
A- Premature ovarian failure
B- PCOS (polycystic ovary syndrome),
C- Hyperprolactinemia ,
D- Poor egg quality,
E- Overactive thyroid gland,
F- Underactive thyroid gland
G- Some chronic conditions, such as AIDS or cancer.

2) **Problems in fallopian tube or uterus** which may have occurred during the pelvic surgery, Sub mucosal fibroids benign or non-cancerous tumors found in the muscular wall of the uterus, Endometriosis, Previous sterilization treatment.

3**) Medications like NSAIDs (non-steroidal anti-inflammatory drugs)** - women who take aspirin or ibuprofen for long-time may find it harder to conceive,
Chemotherapy - some medications used in chemotherapy can result in ovarian failure. In some cases, this side effect of chemotherapy may be permanent.

4) **Radiotherapy** (radiation therapy).
Causes of infertility in male are mainly due to-
1) Low sperm count (low concentration),
2) Abnormal sperms which may be due to -Testicular infection, Testicular cancer, Testicular surgery, Overheating of the testicles, Ejaculation disorders, Varicocele, Undescended testicle, Hypogonadism and Radiotherapy.
3) No sperm and
4) Low sperm mobility (motility).

SIGNS AND SYMPTOMS

The main symptoms of infertility in women include abnormal periods, irregular menstrual period or painful periods. These problems may be due to hormonal changes. The symptoms in female due to hormonal changes are observed as changes in texture of skin including acne; changes in sex drive and desire; dark hair growth on the lips, chest, and chin or loss of hair or thinning of hair on scalp; undue weight gain; milky white discharge from nipples unrelated to breast feeding and pain during intercourse. In male the infertility symptoms include- changes in hair growth, changes in sexual desire; pain, lump, or swelling in the testicles; problems with erection and ejaculation of penis; small & firm testicles.

DIAGNOSIS

The condition can be diagnosed by doing blood, urine, and imaging test. In male the sperm analysis can be done to check the sperm count and the normal functioning of the sperm. Diagnostic evaluation for female include general physical exam, blood test, hysterosalpingography, laparoscopy, pelvic ultrasound and thyroid function test.

TREATMENT

Since the development of various advanced infertility treatments most of the couples are now able to have a child of their own. In order to treat infertility one can adopt natural or medical remedies.

The natural ways mainly include –

1) **Diet** :Having well nourished food like **f**resh organic fruits and vegetables**; w**hole grains, **d**airy proteins, **m**ung & urad d**a**al**, s**oaked almonds **and** walnuts**; s**weet juicy fruits such as mangoes**, peaches, plums, and pears; d**ried fruits such as dates, figs, and raisins; stewed apples for breakfast, a banana cooked in ghee, cinnamon and cardamom in a sweet dish.

2) **Ayurvedic treatment** for infertility which include Swedanam, Vamanam as yogic exercises; banyan tree bark; ashwagandha churna and kapikacchu, guduchi, gokshura and triphala churna, shatavari as medicines; phala/fruits; gritam and fresh nutritious food.

Now modern sciences have such advanced infertility treatments which could be adopted by couples and they can have a baby. Some such methods are:

Medical remedies:

1) Assisted reproductive technology (ART) which include fertility medication for induction of ovulation, artificial insemination, in vitro fertilization and surrogacy, egg donation like IVF using donor eggs, Surgery for infertility can also be done, other methods include intra cytoplasmic sperm injection (ICSI) and cryopreservation. The procedure include removal of the egg from the ovaries and combining it with the sperm and then transferring it into the fallopian tube or the uterine cavity or implanting it to another woman's uterus as in surrogacy.

2) Induction of ovulation: It is a process adopted to induce the ovaries to release eggs by giving medicine. It is more beneficial for those women who are facing low hormonal production required for ovulation. The medication is in the form of tablets or injections.

3) Artificial insemination helps to prevent infertility by inserting the sperm directly into the reproductive organs either in the cervix, fallopian tube or uterus. It is also called as the intrauterine insemination.

) In vitro fertilization (IVF) is a procedure in which the mature ovum is removed from the female with the help of a syringe and similarly the sperm also is removed from the male and both the sperm and the ovum are placed in a test tube for the process of fertilization. Usually the fertilized ovum is kept up to eight cell division stage after fertilization. After that it is implanted in womb of a surrogate mother or in uterus of female counterpart of a couple. IVF can be done by using a donor egg or sperm.

5) Intracytoplasmic sperm injection (ICSI) is also a method of IVF. Here only one sperm is used and is directly injected into the egg. After the fertilization the fertilized ovum is implanted into the uterus or womb.

6) Cryopreservation method for infertility treatment is also an advanced technique used nowadays. In this method the egg, sperm or the leftover embryo from the IVF cycle is frozen and stored for the future used. Usually there are two methods for this procedure one is slow freezing method and other is vitrification (ultra/rapid freezing) method. In this procedure different types of cryoprotectants and freezing solution [with various protocols for sperm, egg and various stages of embryo development] are used to freeze them for the future. The freezing of the embryo can start from the pronuclear stage upto the formation of blastocyst.

7) GIFT (Gamete intrafallopian tube transfer) and ZIFT (zygote intrafallopian transfer)- Like IVF, it is also a procedures to treat infertility which involves retrieving an egg from the woman, combining with sperm in a lab then transferring back to her body. In ZIFT, the fertilized eggs called zygotes are placed in the fallopian tubes within 24 hours. In GIFT, the sperm and eggs are mixed together before being inserted.

RECENT ADVANCEMENTS

A new technique has been developed by the scientists at the University of Cambridge that allows the embryo to develop in vitro beyond the implantation stage. This technique will help the scientists for the first time to analyze the various stages of embryo development for 13 day after fertilization and this will help to improve the chance for the success of IVF [3]. The advancement in the field of science is making more and more miracles to treat the problems of infertility one such advancement is the uterine transplant done recently in US for women with uterine infertility. The transplant was performed on February 24, 2016 at the Cleveland Clinic, in Cleveland, on a patient who is 26 year old [undergone nine hour's surgery]. If everything goes well with time than she will be able to conceive and have a child [4]. The 'test tube baby' era may be replaced by new technique which allows IVF fertilization in womb. In this method doctors harvest eggs and sperm and then place them in a small capsule where they can fertilize in the mother's womb [using the mother's own fluids to help conception]. The technique, involves placing egg and sperm cells into a tiny silicone capsule [the size of a grain of rice], and inserting it into the womb. The tiny silicone capsule contains 360 holes, so fluid from the womb can surround the egg and sperm. After 24 hours the capsule is removed and doctors select the healthiest embryos for implantation into the womb lining of the mother. This technique gives couples a psychological boost, knowing that the child has actually been conceived inside the mother, while the embryos benefit from being in the perfect conditions for fertilization [5].

A study was conducted on "Successful pregnancy following laser-assisted selection of viable but immotile spermatozoa for intra cytoplasmic sperm injection". The result of the study showed that the fertilization rate was 88.89% after ICSI with the laser-selected viable spermatozoa. So the study concluded that noncontact diode laser is a useful alternative for the assessment of sperm viability, which may help to achieve successful pregnancy [6].
A retrospective analysis study was conducted on "Comparison of clinical outcomes of vitrified-thawed embryo transfer and fresh embryos transfer". The objective of the study was to understand the clinical outcomes of frozen embryo transfer and fresh embryo transfer in 870 samples. So the study concluded that there is low implantation rate and clinical pregnancy rate in patient with frozen embryo transfer [7]. A retrospective observational study was conducted on "Number of antral follicles and the success of in vitro fertilization: a multivariate analysis". The study concluded that the antral follicle count decreases over the years, and it is a predictor of the number of retrieved oocytes and can predict the likelihood of the success of in vitro fertilization [8]. Study has conducted to clarify the doubt that whether multiple attempts at embryo transfer affect clinical pregnancy rates. And the result of the study concluded that re-transfer of embryos retained in the transfer catheter does not have any significant effect on clinical pregnancy rates during IVF treatment cycles [9].
A Controlled clinical study was conducted to demonstrate the effectiveness of intracytoplasmic sperm injection to treat male factor infertility and to report on the achievement of fertilization and pregnancy compared with standard in vitro insemination and The study concluded that intracytoplasmic sperm injection can be used successfully to treat couples who have failed IVF or who have too few spermatozoa for conventional methods of in vitro insemination. Sperm parameters do not clearly affect the outcome of this technique [10].

CONCLUSION

From the various research studies it has been found out that infertility problem is rising day by day and year by year. Most of the couples are suffering from this problem. In most of the studies and experiments to find a solution to combat infertility, it has been agreed that we can treat this problem by various advanced methods. Although the techniques cannot replace the natural conceiving but still we can improve or bring back the natural methods by various precautions and treatment techniques. Nowadays many infertility clinics are easily accessible. A healthy lifestyle with a timely and proper treatment can easily cure infertility.

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