



Human Health & Sex Education

Open Course –V Semester

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INFERTILITY AND ASSISTED REPRODUCTIVE TECHNIQUES

INFERTILITY

- Infertility more aptly termed “*absolute infertility*”
- *Sterility* – is the inability to produce sex cells (sperms and ova), or the inability for fertilization and conception.
- *Impotence* and *Frigidity*

Impotence

- Impotence is the inability of an adult male to attain or hold penile erection long enough for successful intercourse.
- On a psychological stand point, it is the recurrent or persistent and partial or complete failure in attaining or maintaining erection until the completion of sexual activity.
- Impotence may be due to the physical abnormalities of penis, syphilis, neurological disorders, deficiency of male sex hormones, fear of sexually transmitted diseases, emotional immaturity, and so on.
- It can be temporary or permanent.

Frigidity

- Frigidity is a female sexual condition, analogous to male impotence.
- It is a state of extreme sexual inertness, or sexual callousness, in which a female is not sexually excitable, responsive, or permissive.
- It is the disinterest, difficulty, or inability of a female to take part in sexual intercourse.
- Frigidity can also be temporary or permanent

Infertility

- Infertility
 - *physiological infertility* - results from physiological disorders
 - *pathological infertility* – results from systemic diseases
- Infertility
 - *absolute infertility* – total inability for reproduction
 - *relative infertility* - diminished capacity for reproduction

Male infertility

- Male infertility is the inability to produce functional sperms or to fertilize ova associated with the non-production of viable sperms, production of abnormal, defective and non-functional sperms, obstructions against the normal movement of sperms through the seminal tract, failure in the proper introduction of sperms into the vagina, etc.

Male infertility

- The major reasons for male infertility are the following.
 - Extreme deficiency of male sex hormones.
 - Non-production of living sperms (*azoospermia*), negligibly low sperm count (*oligospermia*), or the production of defective and non-viable sperms (*necrospermia*).
 - Failure of testicles to descend to a post-abdominal position (*cryptorchidism*).
 - Abnormal rise in scrotal temperature.
 - Non-functional epididymis (highly coiled initial part of sperm duct) due to STDs, tuberculosis, etc.
 - Blockage in the sperm duct.
 - Debilitating diseases.
 - Abnormal coital habits.



Female infertility

- Female infertility is essentially the inability to conceive, defective obstruction and function of the genitalia.

Female infertility

- Its common causes are the following:
 - Non-production of ova.
 - Failure of ovulation due to hormonal insufficiency or hormonal imbalance
 - Blockage in the Fallopian tube (oviduct).
 - Lack of ciliary action in the initial part of the oviduct to move the ovum farther downward.
 - Abnormal development of uterus
 - Uterine tumors which prevent implantation
 - Congenital defects and damages in ovary, oviduct, uterus and vagina
 - Diseases of genital tract (e.g., gonorrhoea), ovary or uterus
 - Exposure to radiation.
 - Drug addiction.

ASSISTED REPRODUCTIVE TECHNOLOGY (ART)

- There are specialized infertility clinics that help in diagnosis and treatment of infertility.
- These specialized treatments are termed ART (Assisted Reproductive Technologies) commonly refers to treatments which facilitate reproduction.
- They include induced ovulation, in vitro fertilization, and other methods
- ARTs include all treatments, procedures, or techniques that involve either the artificial introduction of sperms to female or the surgical removal of eggs from ovary and their subsequent fusion with sperms by artificial methods to help a woman to conceive.

Commonest Methods of ART

- The commonest methods of ART
 - *Artificial Insemination*
 - *In Vitro Fertilization and Embryo Transfer (IVF-ET)*
 - *Gamete Intra Fallopian Transfer (GIFT)*
 - *Zygote Intra Fallopian Transfer (ZIFT)*
 - *Pronuclear Stage Tubal Transfer (PROST)*
 - *Micromanipulation techniques, including Intra Cytoplasmic Sperm Injection (ICSI)*

Artificial Insemination (AI)

- Artificial insemination is the introduction of semen into the vagina of a female by non-coital artificial means.
- This is the oldest and the simplest method of ART. The first reported successful application of this technique was by *John Hunter*, at the fag end of the 13th century
- Artificial insemination employs a sterile syringe to introduce nearly 1ml of semen into the cervix of a female at or just around time of ovulation.

Artificial Insemination (AI)

- The semen is collected from a male into or just around the time of ovulation
- It is collected from a male into a *wide mouthed sterile glass container after three days of abstinence from sexual intercourse.*
- This sample semen has to be used within two hours of collection, after accurate examination of the normalcy of *sperms*, especially their count, motility, and morphology.

Artificial Insemination (AI)

- If *the* semen administered to a woman is collected from her own husband, the procedure is called *homologous artificial insemination*
- If it is obtained from a person other than the husband, the technique is called *heterologous artificial insemination*.
- Now a days, the use of frozen semen, stored in sperm banks for heterologous artificial insemination, is quite *popular*.

In vitro fertilization and embryo transfer (IVF-ET)

- IVF is a process by which an egg is fertilized outside a woman's body.
- It accounts for less than 5% of all types of infertility treatments.
- In this case, eggs are received either from a woman who wishes to become pregnant or from a donor.
- The eggs are then mixed with sperms in a petridish.
- About two days later, the eggs are examined to determine viability and, if successful, one or more viable pre-embryos are implanted in the uterus.

In vitro fertilization and embryo transfer (IVF-ET)

- So, in IVF, early development takes place outside the body(in vitro).
- Later, the embryo is transplanted into the uterus of the mother or a surrogate. This is called embryo transfer (ET).
- IVF-ET method is popularly known as *test tube baby technique*

In vitro fertilization and embryo transfer (IVF-ET)

- IVF-ET was first successfully carried out by the British Scientists *Roberts Edwards* and *Patrick Streptoe* in 1978.
- Essentially, this method consists of four main steps, namely
 - (i) *controlled ovarian hyperstimulation (COH), using ovulation-inducing drugs*
 - (ii) *aspiration of ova from ovary*
 - (iii) *in vitro insemination and fertilization of these ova,*
 - (iv) *transfer of embryos back to the womb (uterus) of a women.*

In vitro fertilization and embryo transfer (IVF-ET)

- The rates of successful pregnancy and delivery vary from clinic to clinic, and they depend also on the age of the woman.
- Women undergoing IVF-ET will have to face an increased risk of ectopic pregnancy, miscarriage, and multiples.
- **Increased risk of damage** to babies is also possible.
- Discarding the surplus embryos amounts to murder of potential human beings.

Test tube baby

- More than 1000 children are born every year through artificial insemination.
- Usually, this method is employed when the male partner is sterile or has a genetic defect, or when the female is unable to conceive.
- In the former, healthy sperms artificially introduced to the female.
- In the later, ovum out from the female using a laparoscope, then fertilized in a test tube that contains a sterile nutrient medium, using the sperm of her husband. This may be called in vitro fertilization or extra uterine gestation.
- The zygote is allowed to develop in the 32 cell stage.
- It is then transferred to the uterus of the mother for implantation and normal development.
- The child produced by this method is called test tube baby.

Test tube baby

- The production of a test tube baby thus involves two steps, namely
 - *in vitro* fertilization
 - embryo transfer.
- The first documented test tube baby was *Louis Joy Brown*, born to *Gilbert Brown* and *Lesley* in England on 25th July, 1978.
- This was the result of the successful effort of *Robert Edwards* and *Patrick Streptoe*
- The first test tube baby in India, *Durga*, was born on 3rd October 1978

Test tube baby

- The process of in vitro fertilization for the production of a test tube baby is an advanced technique and it requires the following precautions.
 - 1. The egg used for *in vitro* fertilization must be fully mature.
 - 2. The egg, the culture medium, and the whole experimental set-up must be kept at a most favourable temperature.
 - 3. Prevention of infection at all stages.
 - 4. Proper preparation of the uterine wall of the recipient mother to receive and retain the embryo and to ensure implantation.
 - 5. Regular monitoring all through the gestation period to ensure that the developing embryo is not detached or expelled

Gamete-intrafallopian transfer (GIFT)

- GIFT is a successful alternative to in vitro fertilization and embryo transfer.
- It is especially applied in those women with prolonged infertility, or with defective or blocked Fallopian tube(s).
- In such the fimbriae (finger-like processes around the opening of the fallopian tube to the body cavity) fail to collect the released ovum.
- In GIFT, sperms and ova are collected, mixed together, and transferred to the Fallopian tube with the help of laparoscope.

Gamete-intrafallopian transfer (GIFT)

- Fertilization and development until blastocyst formation occur in the Fallopian tube
- This is followed by implantation and further embryonic development naturally.

Gamete-intrafallopian transfer (GIFT)

- GIFT involves three major steps
 - (i) Controlled ovarian hyperstimulation (COH)
 - (ii) Aspiration of ova by laparotomy
 - (iii) Transfer of ova and sperms back to the Fallopian tube.
- The technique was first developed by Asch *et al* in 1985.
- The rate of pregnancy with his method varies between 30% and 35% and it may decline with advancing age

Zygote Intrafallopian Transfer (ZIFT)

- Pronuclear Stage Tubal Transfer (PROST), or Zygote Intrafallopian Transfer (ZIFT)
- This is a special option for those women in whom one or both the fallopian tubes are normal.
- This technique was originally developed by Devroey et al in 1989.
- In it, COH is followed by *ultrasound-guided egg aspiration* (USGEA) and *in vitro fertilization*.
- The eggs are observed over 24 hours after insemination to ensure whether pronuclei have formed or not.

Zygote Intrafallopian Transfer (ZIFT)

- The appearance of pronuclei confirms that the eggs have been fertilized.
- Three or more zygotes at the pronuclear stage (prior to first division) are then laparoscopically transferred to the Fallopian tubes.
- Pregnancy may follow. Pregnancy rate may be as high as 45%.
- But the rate of delivery does not usually exceed 17%.

Micromanipulation techniques

- These are the techniques employed to assist fertilization mostly in those cases of infertility with a male factor as the cause component.
- Over the past several years, they have become widely popular as adjuncts to other ARTs.
- Those techniques currently in use include *zona drilling* (Gordon and Talansky 1986), *partial zona dissection* (PZD, Cohen 1989), *perivitelline sperm transfer* (PST, Lasalle et al 1987) and *Intra-Cytoplasmic Sperm Injection* (ICSI-Bongso et al 1989)

Intra-Cytoplasmic Sperm Injection

- This is a specialized procedure in which the sperm is directly injected into the ovum *in vitro*.
- This procedure is used to overcome male infertility problems.
- It may a cases where sperms cannot easily penetrate into the ovum and occasionally as a method of *in vitro* fertilization, especially associated with sperm donation.

Host mothering

- This method – when a female is unable to bear children due to her defective or abnormal uterus.
- In such cases, a tiny embryo is removed from its natural mother and implanted to the uterine wall of a substitute female, called *surrogate mother or host mother*.
- This may be called *embryo transplantation*.
- The foster mother can retain and support the embryo until birth.

Cryopreservation of germ cells and blastocysts

- Cryopreservation is the deep-freezing of sperms, eggs and embryos at -180°C for later use or for research purposes.
- The probable long-term risks of freezing is uncertain.
- Problems related to owner ship may also arise sometimes, unless proper contracts are made.
- Several sections of the society have strong reservation or apprehension against the practice of embryo freezing on the ground that it exposes human beings to grave risks, deprives them of maternal shelter and gestation, and stores them under artificial conditions providing chances for manipulations.

