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Review - In Vitro Fertilization (IVF)

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Abstract

In vitro fertilization (IVF) is a complex step of procedures used to help with fertility. During IVF, mature eggs are collected (retrieved) from ovaries and fertilized by sperm in a lab. Then the fertilized egg (embryo) or eggs (embryos) are transferred to a uterus. One full cycle of IVF takes about three weeks. Sometimes these steps are divided into different parts and the process can take longer. IVF is the most effective form of assisted reproductive technology. The procedure can be done using your own eggs and your partner's sperm. Your chances of getting healthy baby using IVF depend on many factors, such as your age and the cause of infertility. In other hand, IVF can be time-consuming, expensive and invasive.

Key Words: In vitro fertilization, fertility, sperm, embryos etc.

Introduction

What is IVF..?

A procedure in which eggs are removed from a woman's ovary and combined with sperm outside the body to form embryos. Mature eggs are collected (retrieved) from ovaries and fertilized by sperm in a lab. The fertilized egg (embryo) or eggs (embryos) are transferred to a uterus. One full cycle of **IVF** takes about three weeks.

History:

In 1890 - The very first in vitro manipulation of eggs/ embryos was performed by Walter heape, When he transferred in vivo fertilized eggs from one female rabbit to another. In **1959** MC Chang, Successfully Conducted IVF in Rabbit. In15 Feb 1969- The journal nature published a paper authored by R.G. Edwards, B.D. Bavister and P.C. Steptoe "Early stages of fertilization in Virto of human oocytes matured in vitro" & 1977 - The 1st IVF pregnancy in Human and Birth of **Louise Brown.** 2010 - Sir Edwards was awarded as Nobel prize in Physiology or medicine for development of IVF

History in India

Dr. Subhas Mukhopadhyay (1931 to 1981) was the Physician from Kolkata, India, Who created the World 2nd and India's 1st Child using IVF, **"Durga"** who was born 67 days after the first IVF baby in UK. Unfortunately he is harrsed by State government and not allowed to share is achievement with the International scientific community, Dejected, he committed Suicide on 19 Jan 1991. The Critically acclaimed film EK Doctor Ki Maut (1990) was made in his life

Indication of IVF

Tubal Disease

Ovulatory Dysfunction

Age related infertility

Male Factor infertility

Pre-Implantation Genetic Testing (PGT)

IVF Cycle

Initial Evaluation

Suppression of natural hormonal cycle

Ovarian Stimulation

Collection of oocytes

Collection of Sperms

In Vitro Fertilization of oocytes

Embryo transfer

Initial Evaluation

Blood Test

Seminal Fluid examination

Hysterosalpingogram

Trans vaginal Ultrasound

Suppression of Natural Hormonal Cycle

Suppression drug prevent spontaneous ovulation.

In an IVF cycle, It is important that natural ovulation should not occur - if egg leave the Ovary, the doctor is not able to retrieve them.

Drugs

Oral Contraceptive pills

Nafarelin

Ganirelix Acetate injection

Ovarian Stimulation

Ovarian stimulation is used to produce multiple mature follicles, rather than the single Egg normally developed each month

Produces many good follicles to be Fertilized

Multiple eggs are stimulated because some eggs will not fertilize or developed normally after fertilization

Regular monitoring by Ultrasound Scan is done.

Medication

1. hMG Human menopausal Gonadotropin
2. FSH Follicle Stimulating hormone
3. LH Luteinizing hormone (used in conjugation of FSH)
4. hCG Human Chorionic gonadotropin

Generally 8 to 14 days of Stimulation is required

Possible Side effect of ovarian stimulation

Discomfort, bruising or swelling at injection site

Rash

Allergic Sensitivity

Headache

Mood Swings

Abdominal discomfort

Chance of multiple Pregnancies

Collection of oocytes

The oocyte maturation is performed, generally by an injection of human chorionic gonadotropin (hCG).

Commonly, known as "*Trigger shot*"

The egg retrieval is performed at time usually between 34 and 36 Hours after hCG injection,

Egg retrieval is usually accomplished by transvaginal ultrasound aspiration

Its done under short general anesthesia & is 20 to 30 minutes procedure

The eggs are aspirated (removed) from the follicles through the needle connected to a suction device

Usually around 10 to 15 oocytes are aspirated

The Eggs are prepared and stripped from the surrounding cells.

Matured eggs are placed in an IVF Culture medium and transformed to an incubator to await fertilization by the sperm.

Sperm Collection

In the meantime, semen is prepared for fertilization by removing cells and seminal fluid in process called sperm washing

If semen is being provided by sperm donor, it will usually have been prepared for the treatment before frozen and quarantined, and it will be thawed ready for use

Sexual abstinence of 3-4 days should be exercised.

Collected about 60-90 minutes prior to fertilization

The most active sperm are located in the surface of the medium

Sperm may be obtained form testicle, epididymis, or vas deferens from men whose semen is void of sperm either due to an obstruction or lack of production

In Vitro Fertilization of oocytes

After the egg and sperm have been Analyzed and prepared the eggs are then inseminated.

The sperm and the eggs are incubated together in culture media in order for the actual fertilization to take place.

The duration of this Co-incubation should be about 1 to 4 hours to have higher pregnancy rates.

Embryo Transfer

Embryo Transfer may be performed on day 2,3 or 5 post fertilization

One or more embryos suspended in drop of culture medium are drawn into a transfer catheter, a long, thin sterile tube with a syringe on one end.

The physician gently guides the tip of the transfer catheter through the cervix and places the fluid containing the embryos into uterine cavity

Related to age and embryo quality

<35= 2

35-37= 2-3

38-40= 3-4

>40 up to 5

For the patient with 2 or more failed IVF cycles, or a poor prognosis, can add more based on clinical judgement

Advantages of IVF

Blocked tubes:

Older patients/ patients with a low ovarian reserve

Male infertility

Unexplained infertility

Disadvantage of IVF

An IVF cycle may be unsuccessful

Multiple pregnancy

IVF treatment can take an emotional/psychological toll

IVF treatment can be expensive

Percentage of Success

1. **Woman age**

Less than 35 = 65-70%

Between 35-37= 55-60%

Between 38 to 40 = 30-35%

After 41 years 20 %

2. **Other Statistics**

Repetition of four trials 70 -80%

Repetition after three trails 60-65%

If Four Embryos are transferred 40%

If Three Embryos Transfer 35%

If Two Embryos Transfer 25%

If one Embryos Transfer 17%

3. **Other Factor**

Increasing the Number of embryos transferred, the success rate increase

Risk of multiple Pregnancies increase and miscarriage increase

Quality of eggs and Sperm

Conclusion

Patients who have expressed a desire to become parents, but who are in a high-risk group for infertility based on their age, should have a basic fertility evaluation and be referred to a specialist in a timely manner in order to maximize their fertility potential.

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