

Test Tube Baby – Then and Now...

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ABSTRACT

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IVF has become the final solution for most fertility problems, moving from tubal disease to male factor, idiopathic sub fertility, endometriosis, advanced maternal age and anovulation not responding to ovulation induction. Such additional techniques that are routinely used in IVF include ovarian hyper stimulation to retrieve multiple eggs, ultrasound-guided Trans vaginal oocyte retrieval directly from the ovaries, egg and sperm preparation, as well as culture and selection of resultant embryos before embryo transfer back into the uterus.

IVF requires a significant physical, emotional, financial, and time commitment. Stress and depression are common among couples dealing with infertility.

Keywords: IVF, Ovarian hyperstimulation, ICSI

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In vitro fertilization (IVF) is a process by which egg cells are fertilized by sperm outside the body. IVF is a major treatment in infertility when other methods of assisted reproductive technology have failed. The process involves hormonally controlling the ovulatory process, removing ova (eggs) from the woman's ovaries and letting sperm fertilise them in a fluid medium. The fertilised egg (zygote) is then transferred to the patient's uterus with the intent to establish a successful pregnancy.

The term *in vitro*, from the Latin meaning in glass, is used, because early biological experiments involving cultivation of tissues outside the living organism from which they came, were carried out in glass containers such as beakers, test tubes or Petri dishes. Today, the term *in vitro* is used to refer to any biological procedure that is performed outside the organism it would normally be occurring in, to distinguish it from an *in vivo* procedure where the tissue remains inside the living organism within which it is normally found. A colloquial term for babies conceived as the result of IVF, "test tube babies", refers to the tube-shaped containers of glass or plastic resin, called test tubes that are commonly used in chemistry labs and biology labs. However, *in vitro* fertilisation is usually performed in the shallower containers called Petri dishes.

History of IVF

There was a transient biochemical pregnancy reported by Australian Foxtan School researchers in 1953. John

Rock was the first to extract an intact fertilised egg. The first pregnancy achieved through *in vitro* human fertilization of a human oocyte was reported in *The Lancet* from the Monash University team in 1973, although it lasted only a few days and would today be called a biochemical pregnancy. There was also an ectopic pregnancy reported by Patrick Steptoe and Robert Edwards in 1976. In 1977, Steptoe and Edwards successfully carried out a pioneering conception which resulted in the birth of the world's first baby to be conceived by IVF, Louise Brown on 25 July 1978. In October 1978, it was reported that Subash Mukhopadhyaya relatively unknown physician from Kolkata, India was performing experiments on his own with primitive instruments and a household refrigerator and this resulted in a test tube baby, later named as "Durga" (alias Kanupriya Agarwal) who was born on October 3, 1978. However, state authorities prevented him from presenting his work at scientific conferences and, in the absence of scientific evidence; his work is not recognized by the international scientific community.

Steptoe and Edwards were responsible for the world's second (confirmed) baby conceived by IVF, Alastair MacDonald born on 14 January 1979 in Glasgow. A team led by Ian Johnston and Alex Lopata were responsible for Australia's first baby conceived by IVF, Candice Reed born on 23 June 1980 in Melbourne. It was the subsequent use of stimulated cycles with Clomiphene citrate and the use of human chorionic gonadotrophin (hCG) to control and time oocyte

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maturation, thus controlling the time of collection, that converted IVF from a research tool to a clinical treatment.

This was followed by a total of 14 pregnancies resulting in nine births in 1981 with the Monash University team. The ability to freeze and subsequently thaw and transfer embryos has significantly improved the feasibility of IVF use. The other very significant milestone in IVF was the development of the intracytoplasmic sperm injection (ICSI) of single sperms by André van Steirteghem in Brussels, 1992. This has enabled men with minimal sperm production to achieve pregnancies. ICSI is sometimes used in conjunction with sperm recovery, using a testicular fine needle or open testicular biopsy.

Steps of IVF

Thus, IVF has become the final solution for most fertility problems, moving from tubal disease to male factor, idiopathic sub fertility, endometriosis, advanced maternal age and anovulation not responding to ovulation induction. Such additional techniques that are routinely used in IVF include ovarian hyper stimulation to retrieve multiple eggs, ultrasound-guided Trans vaginal oocyte retrieval directly from the ovaries, egg and sperm preparation, as well as culture and selection of resultant embryos before embryo transfer back into the uterus.

Risks of IVF

IVF requires a significant physical, emotional, financial, and time commitment. Stress and depression are common among couples dealing with infertility. A woman taking fertility medicines may have bloating, abdominal pain, mood swings, headaches, and other side effects. Many IVF medicines must be given by injection, often several times a day. In rare cases, fertility drugs may cause ovarian hyper stimulation syndrome (OHSS). This condition causes a buildup of fluid in the abdomen and chest. Symptoms include abdominal pain, bloating, rapid weight gain, decreased urination despite drinking plenty of fluids, nausea, vomiting, and shortness of breath. Mild cases can be treated with bed rest. More severe cases require draining of the fluid with a needle. Medical studies to date have concluded that fertility drugs are not linked to ovarian cancer. Risks of egg retrieval include reactions to anesthesia, bleeding, infection, and damage to structures surrounding the ovaries, including the bowel and bladder. There is a risk of multiple pregnancies when more than one embryo

is placed into the womb. Carrying more than one baby at a time increases the risk of premature birth and low birth weight. IVF is very costly also.

Expansions of IVF

Assisted zona hatching (AZH) is performed shortly before the embryo is transferred to the uterus. A small opening is made in the outer layer surrounding the egg in order to help the embryo hatch out and aid in the implantation process of the growing embryo.

Intracytoplasmic sperm injection (ICSI) is beneficial in the case of male factor infertility where sperm counts are very low or failed fertilization occurred with previous IVF attempt(s). The ICSI procedure involves a single sperm carefully injected into the center of an egg using a micro needle. This method is also sometimes employed when donor sperm is used.

Autologous endometrial co culture is a possible treatment for patients who have failed previous IVF attempts or who have poor embryo quality. The patient's fertilized eggs are placed on top of a layer of cells from the patient's own uterine lining, creating a more natural environment for embryo development.

In Zygote intrafallopian transfer (ZIFT), egg cells are removed from the woman's ovaries and fertilized in the laboratory; the resulting zygote is then placed into the fallopian tube.

Cytoplasmic transfer is the technique in which the contents of a fertile egg from a donor are injected into the infertile egg of the patient along with the sperm.

Egg donors are resources for women with no eggs due to surgery, chemotherapy, or genetic causes; or with poor egg quality, previously unsuccessful IVF cycles or advanced maternal age. In the egg donor process, eggs are retrieved from a donor's ovaries, fertilized in the laboratory with the sperm from the recipient's partner, and the resulting healthy embryos are returned to the recipient's uterus.

Sperm donation may provide the source for the sperm used in IVF procedures where the male partner produces no sperm or has an inheritable disease, or where the woman being treated has no male partner.

A Gestational carrier is an option when a patient's medical condition prevents a safe pregnancy, when a patient has ovaries but no uterus due to congenital absence or previous surgical removal, and where a

patient has no ovaries and is also unable to carry a pregnancy to full term.

Preimplantation genetic diagnosis (PGD) involves the use of genetic screening mechanisms such as Fluorescent In Situ Hybridization (FISH) or Comparative Genomic Hybridization (CGH) to help identify genetically abnormal embryos and improve healthy outcomes. Embryo can be used for twinning to increase the number of available embryos.

Embryo genomics and proteonomics are areas where research is going on to extract the best embryos. A lot of advances are taking place in the field of assisted reproductive technology which may help the infertile couple to achieve their wish in future.¹

END NOTE

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