

Amniocentesis

"Technique of withdrawing a small amount of amniotic fluid from amniotic sac of pregnant woman at early stage of fetal development (15-20weeks) to analyze certain metabolites and chromosomal disorder in fetus."

Process or Procedure of Amniocentesis

An ultrasound is performed prior of amniocentesis for determining a safe location to insert the needle. Then, a long, thin needle is inserted through belly into the amniotic sac of pregnant woman. Once the needle is inserted, a syringe is used for withdrawing a small amount of clear, amber color amniotic fluid. The volume of amniotic fluid withdrawn is depended on the age of fetus and types of tests to be carried out. The extracted amniotic fluid is sent to genetic laboratory for culture of fetal cells and different types of analyzes.

Type of test

1. Karyotype analysis or chromosomal analysis

In this test, cultured fetal cells are analyzed for chromosomal abnormalities. It also helpful to find out the sex of fetus.

2. Biochemical test

In this test, detection of presence or absence of certain enzymes or metabolic features are carried out. It is useful for detection of parental diseases to fetus.

Advantages or positive effects of amniotic fluid analysis

- To detect the chromosomal abnormalities in fetus like Down syndrome, Edward syndrome etc.
- To diagnose of neural tube defects like spinal bifida and anencephaly.
- To find out the sex of baby.
- This test helps to determine presence or absence of specific enzymes.
- It helps to evaluate fetal lung's maturity.

Disadvantages

- After amniocentesis, women may experience cramping, vaginal bleeding or leaking of amniotic fluid.
- Uterine infection such as hepatitis C or HIV, is transfer to the unborn baby.
- There is risk of miscarriage in about one in 200 pregnancies after amniocentesis.

- This technique give opportunity to abort of the healthy female fetus in countries like Nepal.
- This test cannot determine the blood group of fetuses.
- The substantial number of sex-linked recessive genetic defects cannot be detected.

[Note: Need of Amniocentesis

- If parents already had a child with a birth defect or a serious abnormality of a neural tube defect or spinal bifida.
- If pregnant woman is 35 years or older.
- If parent is a known carrier of a genetic disorder, such as cystic fibrosis.
- Help determine if baby's lungs are mature enough to allow child to survive outside of the womb.
- Unborn child has an infection or anemia or mother have a uterine infection.]

Transplantation of tissue and organ

Process of replacement of injured or diseased tissue or organ by healthy one of same individual or from different individual is called transplantation.

- A. Tissue Transplantation: Transplantation or graft of tissue from one part to other part of body of same individual or from different individual is known as Tissue transplantation. For example; skin, tendon, bone, bone marrow etc.
- B. Organ Transplantation: Graft of organ from one body to another for purpose of replacement of damaged or absent organ is called Organ transplantation. It is a decisive procedure, used when survival of an individual is in danger. Organ that transplanted are heart, kidney, liver, pancreas, lung, thymus gland, intestine etc. First heart transplantation was done by **Christian Bernard** in **1967 AD**.

[Note: **Recipient:** The person that receives the transplanted organ is the recipient.
Donor: the person from whose body's organ was taken is the donor.]

Types of transplantation

According to relationship of donor and recipient, transplantation is four types

1. Autograft

It is the graft of tissue from one part of body to other of same individual. In this process, problem of rejection is absent. For example; skin is taken from trunk and can be shifted to arm of same individual.

2. Isograft

It is a graft of tissue or organ between individuals having same genotype such as siblings, identical twins. Rejection is not the problem in this graft.

3. Allograft

It is a graft of tissue or organs between individuals of different genotype of same species. Success rate is moderated.

4. Xenograft

It is the graft of tissue or organs between individuals of different species. For e.g., from monkey to man or from pig to human. The problem of rejection is very high.

Rejection of transplanted organs or tissues:

The main problem is a transplant rejection. It is a process in which transplanted tissue or organ act as antigen and stimulates the immune response in recipient body, leading to

transplant failure and the need immediately remove of transplanted tissue or organ from the recipient. There are different methods of prevention of rejection and they are;

1. Tissue matching or typing

The test must be carried out to match tissue types of the donor with the recipient before transplantation. If the tissue types are matched, survival of transplanted tissue or organ is dramatically increased. Tissue is likely to match between genetically similar members.

2. Use of radiation to suppress the immune system

The rejection process is slow down by exposing the bone marrow and lymphatic tissues to radiation (X-rays) that inhibit the production of WBCs. But the patient has increasing risk of infection during treatment.

3. Use of immune suppression drugs

Rejection process can be delayed by using drugs that inhibit the entire activity of immune system. But the patient becomes susceptible to all kinds of infection and also increases the chance of development of cancer.

4. Use of killer- T cells suppression medicine or monoclonal antibodies

Rejection process can be delayed by using drugs that suppress only cells that responsible for rejection i.e., killer T cells and the rest of immune system of patient would continue to function normally.

Condition required for transplantation

- Tissue matching should be done before transplantation to increase the success.
- Donor should not suffer from diseases like hepatitis, AIDS and Alzheimer etc.
- Transplantation should be carried when donor is alive. In case of death donor, dead body of donor must be put on life support to ensure organs of body are in still at the time of removal.

Application of transplantation

1. Advantages:

- It provides long life span of individual whose survival is in danger.
- It is corrective procedure of burn, injure, broken or diseased tissue.
- It is an achievement of medical science.

2. Disadvantages:

- It is expensive method of treatment
- Patient may die or require long term medications
- Tissue or organ rejection is the usual problem.

- It may enhance organ trafficking and lead to the exploitation of poor people.

Note: Transplantation of **Cornea** is called Karyoplasty and it is one of easiest transplantation because it is not difficult to preserve and rejection process is absent.

Cryopreservation- Preservation of organ or tissue at very cold temperature (-80°C or -196°C).

Test tube baby technique or In vitro fertilization (IVF)

Test tube baby means a child that is conceived outside a woman's body in a laboratory through the scientific process of In-Vitro Fertilization (IVF).

In-vitro fertilization (IVF) is a technique that involved fertilizing an egg outside the body, in a laboratory dish, and then implanting it in same or another woman's uterus to complete normal gestation period.

[**History:** IVF has been used since the late 1970s. On 25 July 1978, the first "test-tube baby," **Louise Brown** in England, was born. **Robert Edwards and Patrick Steptoe**, who collaborated on the procedure, are considered to be the pioneers of IVF.]

Procedure

IVF technique usually involves the following steps:

1. Stimulating the ovaries

Fertility drugs containing the fertility hormones are injected into the donor woman to promote the synchronous growth and maturation of the follicles inside her ovaries.

2. Retrieving or collecting the eggs

The mature eggs are collected through a minor surgical procedure. High number of eggs are collected from the ovaries in one cycle gives the highest chance of a successful pregnancy.

3. Insemination and fertilization

Sperms are collected from the male partner and then washed in cultured fluid to remove the seminal fluid. The eggs; that have been collected, are placed together with sperms and kept in an environmentally controlled chamber. After a few hours later, the sperm should enter into the egg and fertilization takes place. Then, the fertilized egg divides and becomes an embryo. When embryo is 6-8 celled stage within two days, it is transferred to uterus of another woman.

4. Embryo transfer

One or two of the best embryos are selected and are put into uterus of another woman through the vagina by using a thin tube. When the embryo sticks to the lining of the womb and growth of healthy embryo can begin. Female that gives womb for growth and development of artificially fertilized embryo is called **surrogated mother**. She serves as animal incubator and delivers baby after normal gestation period. The baby born by this technique is called test tube baby.

Advantage of test tube baby technique

- It boon to the childless couples.
- It provides comfort to donor mother.
- It is great achievement of medical science.

Disadvantage or Risks of Test tube baby technique

- This technique has a success rate of about less than 20%
- There is a higher chance of having twins, triplets, or more babies.
- Chance of immature birth of baby and development of embryos outside the uterus.
- Increase health risks to the mother.

Note:

1. Surrogate mother:

The surrogate mother is a female that gives womb for growth and development of artificially fertilized embryo. She serves as animal incubator and delivers baby after normal gestation period. She does not contribute anything in term of genetic make-up of baby. Since the ovum comes from donor mother and sperm comes from donor father.

2. Application of IVF technique:

This technique helps those women who are not able to conceive to give birth babies. That may be due to

- The unexplained infertility (like low ovarian reserve, Polycystic Ovary Syndrome or Endometriosis).
- Blocked fallopian tubes.
- Older patients who desire to have a child.
- Male partner infertility.