

Editorial



Dr Golokbihari Maji
MS (Ortho)
Hony Editor, Journal of IMA (JIMA)

ABC of Stem Cell

A stem cell is a cell with the unique ability to develop into specialised cell type in the body. In the future they may be used to replace cells and tissues, that have been damaged or lost due to disease. Our body is made up of many different types of cells/tissues. Most cells are specialised to perform particular functions, such as red blood cells, that carry oxygen around our body in the blood, but they are unable to divide, where as stem cells provide new cells for the body as it grows and replace specialised cells that are damaged or lost. They have two unique properties that enable them to do so; (1) they can divide over and over again to produce new cells. (2) As they divide, they can change into other types of cell that make up the body. There are three main types stem cells.

- (1) Embryonic stem cells. (2) Adult stem cells. (3) Induced pluripotent stem cells.

Embryonic Stem Cell :

Embryonic stem cell supply new cells for an embryo as it grows and develops into a baby. These cells are said to be pluripotent, which means they can change into any cells in the body.

Adult Stem Cell :

Adult Stem Cells supply new cells as an organism grows and to replace cells that are damaged. Adult one are said to be multipotent, which means they can only change into some cells in the body but not any cells i.e.

Blood (or haematopoietic) stem cells can only replace the various types of cells in the blood. Skin (or epithelial) stem cells produce the different types of cells that make up our skin and hair.

Induced Pluripotent Stem Cells :

These are cells called 'IPS cells' that scientists make in the laboratory. Induced means they are made in the lab; by taking normal adult cells like skin or blood cells and reprogramming them to become stem cells; then just like embryonic stem cells they are pluripotent and develop into any type of cell.

The stem cells have several uses.

- (i) In Research : to help us understand the basic biology of how living thing works and what happened when different type of cells are diseased.
- (ii) Therapeutic : to replace lost or damaged cells that our bodies can't replace naturally.

Stem Cells Research :

- (i) To understand how our bodies grow and develop.
- (ii) To find ways of using stem cells to replace cells or tissues that have been damaged or lost.
- (iii) If we understand stem cell development, we may be able to replicate this process to create new cells, tissues and organs.
- (iv) The organ can be studied to find out how they function and how they react to stimulus nimbus like drugs.

Stem Cell Therapy :

Stem cells may be one way of generating new cells that can be transplanted in the body to replace those that are damaged or lost.

Adult stem cells are currently used to treat some conditions, for example :

(i) Blood cells are used to provide a source of healthy blood cells for people with some blood conditions, like thalassaemia and cancer patients who have lost their own blood stem cell.

(ii) Skin stem cells can be used to generate new skin for people with severe burns.

(iii) Age related macular degeneration (AMD) is an example of a disease where stem cells can be used as a new form by treatment in future.

(iv) Stem cells can be used to generate new organs for use in transplant. Induced pluripotent stem cells generated from patient themselves can be used to grow new organs.

How to Generate Induced Pluripotent Stem Cells ?

To generate induced pluripotent stem cells scientist reintroduce the signals that normally deal stem cells to stay as stem cells in the early embryo. These switch off any genes that tell the cell to be specialized, and switch on genes that tell the cell to be a stem cell.

Stem Cells in India :

According to Indian Council of Medical Research, all stem cell therapy in India are considered to be experimental with the exception of bone marrow transplant. Regardless, stem cell therapy is legalised in India. Umbilical cord and adult stem cell treatment are considered permissible. On 15 October 2017 in a move to curb rampant malpractice, India has banned commercial use of stem cell “as elements of therapy” and warned of punishment to erring clinician claiming stem cells cure for diseases through direct or consumer marketing. As per the national guide lines for stem cell research, 2017, at present there is no approved indications for stem cell therapy other than Hematopoietic stem cell transplantation (HSCT) for hematological disorder, like Blood cancer, Leukemia etc.

According to FDA, there are currently only a limited number of stem cell therapies approved by the agency including ones involving bone marrow for bone marrow transplants in cancer care, and cord blood for specific blood related disorders. There is no approved stem cells treatment for other diseases.

FDA warns about stem cell therapies. Researchers hope stem cell will one day be effective in the treatment of many medical conditions and diseases for which few treatment exist.

Today a great hope is set on regenerative medicine in

all medical fields. Leland Kaiper introduced the term ‘Regenerative medicine’ in 1992. He forecasted that “a new branch of medicine will develop that attempt to change the course of chronic diseases in many instances and will regenerate tired and failing organ systems”. The so called induced pluripotent stem cells provide the possibility of autologous therapy, but it bears some essential safety problems.

Scientists now are in a position to treat medical condition; but they may cure or not

1. Spinal cord injury
2. Heart disease
3. Parkinsons disease
4. Alzheimer’s disease
5. Lou gehnig disease
6. Lung disease
7. Arthritis
8. Sickle cell Anamia
9. Organ failure
10. Non union, delayed union and osteonecoris.

Side effects of stem cell therapy :

Decreased appetite, Diarrhea, Abdominal belly ramp, wight loss, yellowing of skin and eyes (Jaundice), Enlarged liver, Bloating abdomen, pain in right upper part of abdomen, increased level of liver enzyme in blood, skin feels tight, dry burning eyes, dryness or painful sore in the mouth, burning sensation when eating acidic foods, bacterial infections, Blockage of smaller air ways of lungs, Autism, Aids, Hair Loss and Eye diseases.

In India as well as globally, only blood stem cells from bone marrow to treat blood cancers and other different blood disorders are permitted. The clinical use in any other disease or use of stem cells other than this is still in research stage. But in India we see a marked contrast. Individuals and institution offer often new cell therapy to all patients. They claim successful use of stem cells in treatment of diseases of heart, liver and other organs, spinal cord damaged by injury even cancer.

The stem cells have high oncogenic potentials. When injected undifferentiated they can cause ‘Teratoma’. The use of adult stem cells raised less ethical concern. The adult stem cells can differentiate in cell types of the tissue in stem which they reside. Mesenchymal stem cells are most promising as they show good differentiations towards cartilage, tendon and bone cells; they are mainly bone marrow, fat, amniotic membrane, periosteum. There are two different strategies of this types of cell therapy.

(I) Cell therapy: The cell suspension is simply injected into the damaged tissue or into blood circulation.

(II) Tissue engineering- It is a complex one where cells are combined with a three dimensional matrix to compose a tissue like construct to substitute lost part of the tissue.