

Stem Cells in Surgery

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Stem cells comprise the cellular foundation of all tissues and organs within the body. These versatile cells, known as the primary building blocks, have the remarkable capacity to differentiate into any cell type found in the organism. They are distributed throughout the body in various locations as needed. Thus, it plays a role in the regeneration of all tissues and organs that are sick or damaged. The concept of a stem cell refers to a unique group of cells that possess the extraordinary ability to originate from a single cell and undergo differentiation, proliferation, and self-renewal into diverse tissue types without undergoing any significant changes.^[1]

Each type of cell has a structure and size that suits its function. Cells with similar functionality make up tissues, and tissues make up organs. Embryonic stem cells are cells in the womb that have only just begun to develop and have only been fertilized a few days ago. These cells can transform into more than two hundred types of cells in our body. Embryonic stem cells can bring a person into being from scratch, or cloning can take place. For this reason, the study of embryonic stem cells by all world countries has been restricted for ethical reasons. Embryonic stem cells are a type of stem cell that is emphasized in

ABSTRACT

Stem cells are essential components responsible for the development of all tissues and organs in the human body before they differentiate into specific cell types. These undifferentiated cells possess the remarkable ability to divide and regenerate themselves, thereby contributing to the formation of various organs and tissues. When there is an injury or damage in any part of the body, stem cells migrate to the affected area and differentiate into the specific cell types required for tissue repair. Our organs consist of diverse cell types, and stem cells play a vital role in replenishing damaged cells and maintaining tissue health. They have the capability to renew and restore the affected region, providing healing and regeneration. Stem cells, with their unlimited potential for division, serve as guardians of our overall well-being. In this chapter, the varieties of stem cells and how they are used in surgery will be examined.

Keywords: Stem cells, surgery, treatment, repair, regeneration.

the field of tissue engineering and regenerative medicine due to their ability to transform into all kinds of cells and tissues in living organisms and their unlimited dividing ability. All cells in the organism can divide and change, and the cells with the greatest differentiation potential are totipotent stem cells. It does not matter whether it is structurally outside or inside the embryo and forms the structures.^[2]

Fetal stem cells are usually a type of stem cell obtained from an 8-12 week old fetus. It cannot rebuild a body, but it has the capacity to transform into almost all cells. It can be transplanted to another person and is used for therapeutic purposes around the world. However, although there is no proof yet, research studies are continuing by scientists since the risk of forming a tumor in the body where it is transplanted is suspected if it is reproduced before it is given to another body. It is used a lot for procedures that are usually in the clinic and is easily separated from the cells discarded at birth and does not cause problems when isolated.^[3,4]

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Varieties of stem cells are shown in Figure 1.

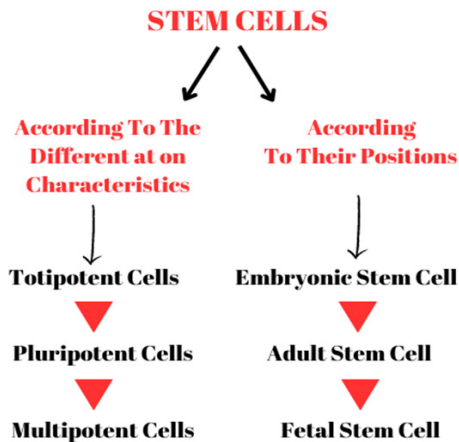


Figure 1. Types of stem cells.

Adult stem cells are in an unspecialized state and are among other cells in tissues and organs. They have the ability to renew themselves or turn into cells of the tissue or organ in which they are located. Stem cells are predisposed to differentiation totipotent, and pluripotent and they are divided into three names multipotent. First, multipotent cells are cells in a particular cluster that have enough to differentiate between all kinds of cells. They are most favored in joint and orthopedic diseases, immunologic and autoimmune diseases.^[5] However, the development of pluripotent stem cells has led to studies in different locations in new science, promising to develop more from day to day.^[6]

The differentiation process of stem cells is also shown in Figure 2.

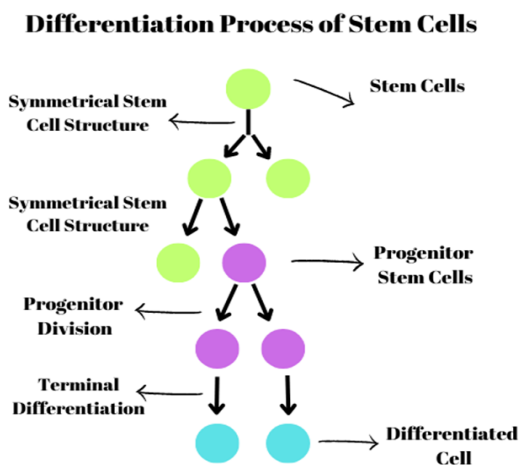


Figure 2. Stem cells differentiation process.

There have been many examples of successful applications of stem cell therapies not only in surgery but also in the clinic. There have been very successful results, particularly in orthopedic surgery for bone marrow and joint diseases, skin regeneration in plastic surgery, and repair in cosmetic surgery.^[7]

Oculoplastic Surgery

Oculoplastic surgery is the name given to a general surgical approach that covers the surroundings of the eye socket area, where our eyes reside in the skull, and the tissues inside. It is a surgical method used in the treatment of eye-related diseases such as correction of eyelids that are more open or closed than normal, placement of prominent eyes, and strabismus. For example, Ki67 and nestin found in the tear gland are very valuable stem cells for tissue. We quite need these stem cells in terms of conservation, eye diseases, vision impairments, and repair. Somatic cells collected from the individual who has any eye disease stem cells found in the lacrimal gland can be modified. Here it is crucial to administer stem cell therapy in the right steps and not err on the mechanisms of repair.^[8,9]

Stem cell therapy is being developed not only for tear glands, but in various places covering the formation of synthetic lacrimal glands, impairments in the eyelid, and other impairments of visual pathways, and also mesenchymal stem cells are of interest.^[10,11]

Arthroscopic and Orthopedic Surgery

Arthroscopy, which means imaging any joint in the body through a camera, is a surgical procedure to diagnose and treat structural problems that cause pain, imbalance, or other dysfunctions that occur in the joints, and stem cell research has now begun in this area as well. There are still studies underway for the regeneration of tissue structure and function after damage, the effort to maintain the cell's own balances in the face of the negatives happening around it, and the isolation of these stem cells needed for active regulation of internal balance (homeostasis) in changing conditions, and the initiation of treatment methods. Mesenchymal cells provided for isolation from the bone marrow are indispensable sources of stem cells for orthopedic surgeries, but adiposis stem cells were considered more appropriate since they increased the likelihood of inflammation and the pain of the person undergoing surgery. For this reason, instead of mesenchymal cells, adiposis cells have been a useful route for arthroscopic surgery.^[12,13]

In orthopedic surgery, the medical specialty of studying, preventing, and treating birth-induced, later-acquired, or spinning-induced aneurysms that study the musculoskeletal system and its problems and alter the shape and function of the body's movement system, stem cell treatment methods have also begun. Progenitor stem cells directly isolated from the marrow immediately initiate regeneration and repair. This process is done by passing quickly to the body by injector into tissues. Once these cells are sufficiently altered, they begin healthier bone repair and produce the formation of neurogenesis, tendon, and cartilage. While working with mesenchymal cells in this area, a healthy study with the optimal stem cell has yet to be done. Stem cell sources used in orthopedics are classified as stem cells originating from the bone province, stem cells originating from fat, stem cells originating from synovial tissue, peripheral blood-derived progenitor cells, and concentrating bone province.^[14]

Plastic Surgery

Plastic Surgery is a surgical discipline that covers the redevelopment, shaping, and removal of severe tissue losses and all forms of aesthetic initiatives on the body. The use of stem cells in plastic surgery is mostly for aesthetic purposes such as eliminating unwanted scars in the body, beautifying the face and body, providing a younger appearance, and achieving successful results. The ability of stem cells to regenerate themselves and change differentiation in repair is an important feature of plastic surgery.^[15,16]

Heart Surgery

Heart and vascular surgery are surgical operations performed on the heart or four large vessels performed by cardiac surgeons. Although stem cells have just begun to be administered in this branch of surgery, there has been an observation of improvement in heart function after stem cell transplantation in patients who have had a myocardial infarction. Apart from repairing and protecting myocardial tissue, it can also enable the re-production of these tissues and the development of new blood vessels. It directly improves damaged areas through the injection method and has therefore become a treatment that can also be administered in chronic heart patients. But they have a variety of methods, and which method to use is of great importance. For example, while the success rate is high in areas where damage is smaller, necrosis occurs in areas with severe and major damage. Localization, size, and shape of the transplanted stem cell are important in heart surgery

to be suitable with host tissue.^[17] Also in determining the optimum stem cell, heart surgery is a very appropriate branch to understand the type of cell and the amount it should be, the optimal conditions in the course of treatment. It offers an opportunity to see the growth factor in open-heart surgeries directly in terms of veins.^[18,19]

Stem Cell Treatments Involved in Other Surgical Applications

Another common disease among the general public is liver disease. Liver diseases are very difficult to treat due to tissue organ discrepancies and financial problems. Improving the liver through various stem cell methods is still a matter of research, and repair in the tissue was decided after mouse experiments were conducted so that it could be used for regeneration. It is expected that liver transplant processes will also decrease when this differentiation process is successful and when the correct method is found in the formation of hepatocytes.^[20,21]

In vitro methods were used in differentiation and hepatocyte growth factor for liver repair, oncostatin M, and active A factors were administered, providing mesenchymal stem cells.

Not only hepatocytes but liver progenitor cells and bile duct cells were also found to be able to regenerate the liver after the transplant process was performed on the unhealthy liver.^[22]

Although there is not much writing about it, work has begun on stem cell methods aimed at addressing hearing impairments and hearing losses in the inner ear. Only mesenchymal stem cells are considered suitable, and animal studies have found success in terms of internal ear repair.^[23] It is thought that it would be possible to repair cochlear damage based on the results of animal experiments after creating stem cells that can differentiate, in order for the hearing to regenerate.^[24]

Adipose tissue is a tissue called adipocytes that is created by cells, a large part of which is covered by a fat droplet. Unlike other organs, adiposis tissue, which shows distribution throughout the body, is highly dynamic. Small differences can be seen in the gene expression patterns of adipose tissue cells based on body placements. Peripheral nerve surgery uses fat-borne stem cells, with direct or indirect methods available. The increase of mesenchymal stem cells is important for their repair.^[25,26]

In conclusion, stem cells are a special type of cell division that they use to create their own copies, and

have continued to evolve and evolve as a treatment method for various ailments. Especially repair, cell differentiation, transformation into tissues, unlimited divisibility, and damage to tissues are valuable to create new cells that can regenerate themselves. The skin, bone cells, and liver cells that form living organisms are differentiated in both structure and function in order to perform different tasks. Due to these characteristics, organ failure, heart diseases, rheumatic bone-muscle and joint diseases, and nervous system diseases are considered treatment methods for many conditions. The use of stem cells has been identified as a very successful treatment method, especially in cases of tissue organ disputes and transplant-requiring organ diseases where the appropriate donor cannot be found and transplants cannot be performed. Although not all of them have been discovered, it is predicted that the potential to cure many diseases will lead to great facial laughter.

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