Summary and Conclusion

Stem cells are defined as; unspecialized cells in the human body that are capable of becoming specialized cells, each with new specialized cell functions. The best example of a stem cell is the bone marrow stem cell that is unspecialized and able to specialize into blood cells, such as white blood cells and red blood cells, and these new cell types have special functions.

Stem cells should possess two characteristic features: first, they must be able to renew themselves and, second, they must have the capacity for multilineage differentiation, However, stem cells have varying degrees of potential. This ranges from the totipotency of the fertilised oocyte (the zygote), to the pluripotency of embryonic stem cells, to the multipotentiality of most tissue based stem cells, and lastly to the unipotentiality (only able to generate one cell type) of cells such as the epidermal stem cells and the spermatogonial cells of the testis.

Between the stem cell and its terminal progeny there are usually several intermediate cells of increasing commitment. These are known as transit amplifying cells. Stem cells are relatively undifferentiated, and in most tissues are not able to carry out the specialist functions of the progeny to which they give rise. In most tissues, stem cells form a minority population, usually only 1–2% or less of the total cellularity.

Embryonic stem cells seem to be more flexible than stem cells found in adults, because they have the potential to produce every cell type in the human body. They are also generally easier to collect, purify and maintain in the laboratory than adult stem cells.

Scientists can induce embryonic stem cells to replicate themselves in an undifferentiated state for very long periods of time before stimulating them to create specialized cells. This means that just a few embryonic stem cells can build a large bank of stem cells to be used in experiments.

Adult stem cells are hidden deep within organs, surrounded by millions of ordinary cells, and may help replenish some of the body's cells when needed. In fact, some adult stem cells are currently being used in therapies. They have been found in several organs that need a constant supply of cells, such as the blood, skin, and lining of the gut, and have also been found in surprising places like the brain, which is not known to readily replenish its cells.

Cord blood stem cells are obtained from the umbilical cord blood. Cord blood stem cells have been shown to be multipotent by being able to differentiate into neurons and liver cells. The two mesodermal tissues known to harbor stem cells that normally regenerate tissues are bone and muscle. Bone marrow is home to hematopoietic stem cells (HSCs), marrow stromal, or mesenchymal stem cells (MSCs), and endothelial stem cells (EnSCs). MSCs ar also present in the endosteum covering trabecular bon surfaces and in the lower layers of the periosteum next to the surface of the bone.

Differentiated epithelial cells turn over continuously and contain stem cells whose function is to replenish the lost cells or reconstitute the epithelium after loss by injury or disease. Epithelial stem cells performing these functions reside in the nervous system, the epidermis of the skin, hair follicles, the cornea, and the epithelia of the respiratory and digestive systems, including liver and pancreatic stem cells.

Differentiation of embryonic stem cells occurs spontaneously or through directed differentiation. Researchers choose the initial culturing conditions that prevent spontaneous differentiation. This involves growing the cells on a layer of feeder cells that secrete substances into the culture media that help nourish the ES cells. Feeder cells help maintain the stem cells in an undifferentiated state; they also provide a favorable substrate for the embryonic stem cells to grow on Collecting human stem cells, whether from an adult or an embryo, is just the first part in a long line of procedures that, hopefully, will lead to a treatment for a medical disorder.

Identifying a stem cell is not always easy. Adult stem cells account for only one out of 100,000 cells of the total cell population, so the odds of finding one, at the best of times, are small indeed. Stem cells have a simple morphology, and one might think this would set them apart from other cells in the body, but there are many differentiated cells that have a similar size and shape. The situation with ES cells is a little better, since their source and identity are known without question.

However, all stem cells change somewhat when placed in culture, making it necessary to monitor their behavior and to track any changes in their state of differentiation. Scientists have developed a set of markers that work for both mice and humans, which simplify the identification of stem cells and the evaluation of their phenotype. There are many different stem cell markers, but they all fall within one of three groups: glycoprotein receptors that are embedded in the cell membrane; cell-specific gene expression; and cell-specific molecules such as hormones, enzymes, or structural proteins.

The therapeutic applications of stem cells is a promising and rapidly emerging branch of regenerative medicine in which stem cell-based

treatments could be applied to treat and cure many aggressive and lethal diseases in humans. Numerous recent investigations carried out with *ex vivo* expanded and or differentiated ESC-, fetal-, and UC stem cell-derived fully functional progeny as well as adult stem/progenitor cells have provided accumulating evidence supporting their potential use for the treatment of numerous genetic and degenerative disorders.

The autologous or allogeneic transplantation of stem cells or their further differentiated progeny into patients may notably constitute a potential therapeutic strategy, alone or in combination with the conventional treatments, for overcoming the progressive loss of functions of adult stem cells with aging and degenerative diseases.

HSCT in Crohn's disease is Feasible shows encouraging results, demonstrating overall safety and both clinical and endoscopic remission as well as improved quality of life in the vast majority of patients . Indeed, all patients reached complete clinical remission within a short period, demonstrating that HSCT can induce clinical and endoscopic remission in previously refractory patients.

Expanded adipose-derived stem cells (ASCs) derived from lipoaspirates appear to be a novel tool for repair complex perianal fistula including Crohn's disease. The primary end point was fistula healing, defined as the absence of drainage through the external openings both spontaneously and after externally applied pressure, as well as complete epithelization of external openings. This is a more stringent definition than that used in the majority of studies of fistulas (e.g., decrease in flow through the external hole upon application of pressure to the surrounding area). ASCs proved more effective in patients with a suprasphincteric

fistulous tract. After 1 year of follow-up, the recurrence rate in ASC-treated patients was low. Although Crohn's disease is the worst condition for a surgical approach in cases of rectovaginal fistula, good closure was observed.

At this point, surgical procedure as vaginal flap previously performed without injecting stem cells failed in the early postoperative period. Moreover, in the present intervention a detachment of the vaginal advanced flap was observed 2 weeks after surgery, without rectovaginal fistula relapse, and 12 months later the rectovaginal fistula still remained closed. Thus the new stem cell-based approach seemed to be effective.

A novel strategy has been developed known as cell-assisted lipotransfer (CAL). In CAL, autologous adipose-derived stem (stromal) cells (ASCs) are used in combination with lipoinjection for cosmetic breast augmentation. Compared with breast augmentation using implants of the same size, augmentation with CAL showed a lower height but a more natural contour of the breasts. All cases showed natural softness of the breasts without any palpable nodules at 6 months, and all the patients were satisfied with the resulting texture, softness, contour, and absence of foreign materials despite the limited size increase possible with autologous tissue.

ASCs were used as a potential source for cell-based therapies for healing calvarial defects. The adipose-derived stem cells were seeded in apatite-coated scaffolds and implanted into the surgically created, critical-size calvarial defects.

MSCs have been used with promising results in skin repair and regeneration after various acute and chronic skin injuries, such as acute incisional and excisional wounds, diabetic skin ulcers, radiation burns,

and thermal burns. However, most research has investigated their contribution to repair after skin incision and excision wounding.

Autologous stem cell-based therapy for critical limb ischemia offers many advantages over other nonsurgical treatments of PAD. Autologous adult stem cells are not rejected and do not form teratomas. Thus, our early preliminary results indicate that adult stem cell therapy is safe and effective in patients with critical limb ischemia. Amputation was prevented with relief of symptoms and improvement in function in 80% of patients.

Stem cell-based strategies have been proposed to replace lost neurons in degenerative diseases such as Parkinson's disease, and amyotrophic lateral sclerosis (Lou Gehrig's disease), or to replace lost oligodendrocytes in demyelinating diseases such as multiple sclerosis. Stem cells have also been implicated in repair of the adult spinal cord.

Functionally complete spinal cord injured patients received a BMSC transplant combined with the administration of GM-CSF . All patients were operated during the first 2 weeks after injury .Patients motor and sensory function improved.

Hematopoietic stem cells are used, with promising results, for autoimmune diseases, refractory anemia, severe aplastic anemia, congenital thrombocytopenia, osteoporosis, chronic inflammatory bowel disorders including Crohn's disease and ulcerative colitis, diabetes, leukemias, multiple myeloma, and Hodgkin's and non-Hodgkin's lymphomas may be treated by HSC transplants, alone or in combination therapies.