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### Editorial

## Stem Cell Therapy: Promises versus Challenges

**Arambam Giridhari Singh,**

*Professor, Department of Biochemistry*

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"Can **stem cells** help me Clive"? The person asking this question was Jeff Kaufman a Wisconsin man in his 40s, completely paralyzed by amyotrophic lateral sclerosis (ALS). On the receiving end was Clive Svendsen, a stem cell researcher in the University of Wisconsin-Madison. Svendsen knew how long the trial may take and being a realistic man replied as quoted "yes Jeff, but it's going to take time and money. He started his ALS chapter in 2003 with Jeff as one of his patients. Jeff died in 2010 due complications from ALS. After 15 years of his ALS chapter, Svendsen, while working for his new assignment on an approved trial of ALS patients, clearly pointed out that a lot has been accomplished in the last 15 years and the next 15 years will likely offer new insights into ALS. He is still not assuring a complete cure of the disease. In the meantime what concerned Svendsen was the appearance of charlatans spreading false claims that ALS patients can be cured by 40,000 USD [1]. This part of an article written by Karen Ring prompted me to write this editorial

**Stem cell is defined as an undifferentiated cell of a multicellular organism which is capable of giving rise to indefinitely more cells of the same type and from which other kinds of cells arises by differentiation.**

There are 5 **stem cell** types based on the extent to which they can differentiate into different cell types

- (1) **Totipotent stem cells:** Most powerful stem cells which can differentiate into embryonic and extra embryonic tissues, most important characteristic being their ability to generate a fully functional living organism. Example: 2-3 days old fertilized egg.
- (2) **Pluripotent stem cells:** Next most powerful cells, characteristics being their ability to do self renewal and differentiate into any of the three germ layers (ectoderm, endoderm and mesoderm) which can further differentiate into all tissues or organs. Example: 3-5 days old **embryonic cells**. A new stem cell with properties similar to embryonic stem cell was created after being engineered from mouse cell in 2006 and from matured human cell in 2007 by manipulating the expression of certain genes by reprogramming somatic cells back to the pluripotent state hence, named as **Induced pluripotent stem cell (iPSC)**.
- (3) **Multipotent stem cells** which can develop into more cells but only for closely related family of cells. **Hematopoietic (adult) stem cells** are the examples as they can produce all the blood cells.
- (4) **Oligopotent stem cells** when differentiated into a few cells e.g lymphoid or myeloid stem cells

- (5) **Unipotent stem cells** when differentiated into only cells of their own type eg muscle stem cells [2].

#### **Chronology of Stem Cell Research**

Alexander A.M. was the first person to show that all blood cells are derived from a common precursor cell which he proposed as hemopoietic stem cell and identified it within mesenchyme as mesenchymal stem cell in the year 1924. The progress of the research was very slow till the bone marrow transplantation as treatment for leukemia in 1956 by Dr E Donnall Thomas in New York, the donor being a twin sibling followed by another transplant using bone marrow from a non-twin sibling in 1968. After this bone marrow transplantation, the basic concept being the presence of stem cells in bone marrow which can produce millions of blood cells, the idea of the use of stem cell as regenerative medicine progressed. At the earlier stages researchers' concentration were mostly towards isolation or creation of stem cells. Hemopoietic stem cell was discovered from cord blood, in 1978, extraction of mouse embryonic stem cell in 1981, multipotent stem cell from mouse brain in 1987, neuronal stem cell from striated tissues in 1992, existence of cancer stem cells in 1997, creation of mouse induced pluripotent stem cell in 2006 and human induced pluripotent stem cell in 2007, the first human clinical trials in the year 2010, advanced cell development programs in 2012 and in the year 2014, US and Japan jointly discovered that any adult cell can potentially rewind back to a pre embryonic state using a simple test [3]. However, during the last a decade and half, not a single breakthrough towards its use as regenerative medicine have so far been reported.

**Promises from the stem cell researchers;** Treatments by restoration of tissues or organs for the patients suffering from injuries or chronic diseases is now considered to be the most recent and emerging branch of medical sciences. The stem cell, by virtue of its being capable of self renewal and differentiation into other cell types, its research has laid the foundation for such cell based therapies for diseases which cannot be cured by conventional medicine. It can be used to regenerate neurons damaged by spinal cord injury, stroke, Alzheimer's disease, Parkinson's disease or any other neurological problems. It can also produce heart muscle cells that could repair damaged heart after heart attack or replace virtually any tissue or organ that is injured or diseased. Now, they are treated as seeds of tissue repair, regeneration and a promising source of novel therapy. Its research still holds **great promise** for alleviating the suffering of millions of patients .A number of human disorders are on the line for clinical trials starting from Alzheimer's Disease, Parkinson's disease, Myocardial infarction, Amyotrophic Lateral Sclerosis , Autism, Brain Tumor, Cardiomyopathy, Diabetes type 1 and many more [4].

**Challenges facing by the stem cell researchers:-** Some of the important challenges are as listed below.

- (1) Ethical issues are there because; human embryo dies while isolating the stem cells.
- (2) Another challenge with embryonic stem cell is the difficulties in reproducing them in the laboratory and triggers them to differentiate into specific cell types.
- (3) They could also overgrow as happen in the case of cancers.
- (4) The potential of induced pluripotent stem cells are yet to be compared to embryonic stem cell.
- (5) Identification of stem cell in adult tissue is a major difficulty encountering by the scientists.

- (6) Integration of the stem cell transplanted to the patient's body system is still a challenge.
- (7) The major problem to successful stem cell transplant is the prevention of immune rejection.
- (8) Stem cells for cancer treatment is difficult as it can foster cancer cells [5].

**Despite the numerous challenges being faced by the researchers, the stem cells still hold promises for treating many diseases. This, so called regenerative medicine, has great potential and has already delivered some breakthrough but, its future is at risk because of charlatans, poor science, unreliable hopes, unclear funding models and unscrupulous clinics.**

This editorial started from a shocking real life story, again let me also conclude it with another equally shocking real life story; Doris Tyler, an elderly lady, a suspected patient of macular degeneration, being lured by one of the mushrooming stem cell clinics in Georgia, USA, in 2016, consented to extract her fat for injecting into her eye, where she was told the stem cells present in it could halt or even cure the macular degeneration threatening her sight. Five days after the injection, the clinic boasted online that it had performed the first such treatment in Georgia and urged others with her disease to book for appointment. But, contrary to her expectation, Tyler's vision deteriorated and within a few months, she said she was completely blind.[6].

Well, the message I intend to convey to my colleagues here via this editorial is that, we should all avoid peddling unproven cures of stem cell treatments for financial gains.\

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