STEM CELL CONCEPT OF HEALING— REGENERATIVE MEDICINE

Currently, the field of stem cell biology has emerged at the forefront of healing of injured tissue, treatment of diseases and holds promise for tissue transplantation in future. Stem cells are the primitive cells which have 2 main properties:

i) They have capacity for self renewal.

ii) They can be coaxed into multilineage differentation (i.e. into any of about 220 types of cells e.g. red cells, myocardial fibres, neurons etc).

Stem cells exist in both embryos and in adult tissues:

In embryos, they function to generate new organs and tissues; their presence for organogenesis has been an established fact.

In adults, they normally function to replace cells during the natural course of cell turnover.

For example, stem cells in the bone marrow which sponateously differentiate into mature haematopoietic cells has been known for a long time.

However, what is new about stem cells is as follows:

i) Stem cells exist in almost all adult tissues called somatic stem cells and are less numerous.

ii) Other sources of stem cells are embryos and umbilical cord blood; these stem cells are more numerous.

iii) Stem cells can be harvested and grown in the laboratory into a desired cell lineage by transdifferentiation i.e. these cells are pleuropotent.

iv) Homing of transfused stem cells is their innate abilty to travel to the desired site in the body and thus they get engrafted there morphologically and functionally.

Some of the major clinical trials on applications of stem cells underway are in the following directions:

1. Bone marrow stem cells: --Haematopoieitc stem cells, marrow stromal cells and stem cells sourced from umbilical cord blood have been used for treatment of various forms of blood cancers and other blood disorders for about three decades. However, their use for treatment of other diseases by transdifferentiation is relatively new.
2. Neuron stem cells:-- These cells are capable of generating neurons, astrocytes and oligodendroglial cells. It may be possible to use these cells in neurodegenerative diseases such as Parkinsonism and Alzheimer's disease, and in spinal cord injury.

Thus, the accepted concept that neurons do not regenerate may not hold true anymore.

3. Islet cell stem cells:-- Clinical trials are under way for use.

4. Cardiac stem cells:-- It is now known that the heart has cardiac stem cells which have capacity to repair myocardium after infarction.

5. Skeletal muscle stem cells:-- Although skeletal muscle cells do not divide when injured, stem cells of muscle have capacity to regenerate.

6. Adult eye stem cells:-- The cornea of the eye contains stem cells in the region of limbus. These limbal stem cells have a potential therapeutic use in corneal opacities and damage to the conjunctiva.

7. Skin stem cells:-- In the skin, the stem cells are located in the region of hair follicle and sebaceous glands. These stem cells contribute to repair of damaged epidermis. While healing in adults normally takes place with formation of scar and loss of hair, stem cells would elicit a response similar to wound healing in foetal tissue where the healing is by regeneration.

8. Liver stem cells:-- In the liver, the stem cells are located in the canal of Hering which connects the bile ductules with hepatocytes. These cells can cause regeneration of fulminant damage to the liver or in chronic hepatitis.

9. Intestinal stem cells:-- Crypts of the intestine contain stem cells which form the villi.

10. Lung tissue stem cells:-- Clinical trials on the repair of injured lung parenchyma in patients of Chronic Obstructive Pulmonary Disease (COPD) is going on.