REPAIR

- **Definition:** Repair is the replacement of damaged tissue by new healthy one.
  Factors Affecting Repair:
  I. Local Factors:
  (1) ***Severity of tissue damage.***
  (2) ***Type of damaged cells:*** Labile, stable or permanent cells.
  (3) ***Blood supply:*** Poor blood supply delays repair.
  (4) ***Infection and presence of foreign bodies:*** Delay repair.

- **II. General Factors:**
  (1) ***Age:*** Repair is more rapid in young age.
  (2) ***Protein deficiency:*** Specially of sulphur containing amino acids delay repair.
  (3) ***Vitamin deficiency:*** Vitamin C deficiency causes defective formation of collagen and osteoid tissue. Vitamin D deficiency causes failure of calcification of osteoid tissue.
  (4) ***Zinc deficiency:*** Zinc is necessary for collagen synthesis.
  (5) ***Glucocorticosteroids and cytotoxic drugs:*** Delay repair.
  (6) ***Diabetes mellitus:*** delays repair.

- **Types of Repair:**
  I. Regeneration.
  II. Healing by fibrosis.
  I. REGENERATION
  Definition: The replacement of damaged cells by new cells of the same kind. This is done by proliferation of the surrounding living cells. Cells of the body are divided according to the power of regeneration into three groups:
  (1) **Labile Cells:** These cells proliferate continuously throughout life includes surface epithelium, epithelia of respiratory and alimentary tract, Haemopoietic tissues. Healing occurs by regeneration.
  (2) **Stable Cells**: Do not proliferate under normal conditions, but proliferate when there is a need includes Parenchymatous cells (Liver, pancreas, renal tubules), mesenchymal cells **(** Fibroblasts, chondroblasts and osteoblasts). Regeneration occurs with small damage to stable cells, while repair with fibrosis occurs in large damage.
  (3) **Permanent Cells:** Cannot proliferate at all, includes muscle cells, nerve cells. Healing occurs by fibrosis and gliosis for nerve cells.

- **EXAMPLES OF REGENERATION**
  I. Regeneration of Skin: The epidermis is labile cells heal by regenerate. The dermis heals by fibrosis.
  II. Regeneration of Liver Cells: When the damage is mild heal by regeneration. When the damage is severe heal by fibrosis.

- **III.Repair of Bone fracture:**
  For bony union to occur adequate immobilization is needed. The stages of healing are:
  (1) ***Hematoma formation:***
  (2) ***Traumatic inflammation:*** Inflammatory reaction in the bony end with scanty inflammatory exudate collects, rapidly removed by macrophages. (3)
  Formation of granulation tissue (soft callus): The hematoma is then invaded by capillary loops and mesenchymal cells frome periosteum and endosteum. The granulation tissue formed is called “soft callus”.

- (4) ***Formation of provisional callus:*** The mesenchymal cells differentiate into osteoblasts and chondroblasts, start bone (osteoid) and cartilage formation in the soft callus which become hard and called “provisional callus”. This callus involves
  –external callus: the part of callus under the periosteum.
  –Internal callus: the part of callus lies inside the medullary canal.
  -Intermediate callus: the part of callus which unites the broken ends
  (5) ***Formation of lamellar bone:*** The osteoblast secrete alkaline phosphatase, which leads to calcification of osteoid and cartilage. Calcified cartilage disintegrates and endochondral ossification occurs. The osteoid in which collagen bundles are irregularly arranged, calcifies to form woven bone (lamellar bone).
  (6) ***Remodeling:*** During lamellar bone formation the external and internal callus are removed by osteoclasts. The intermediate callus undergoes remodeling by osteoblastic and osteoclastic activity.
  (7) ***Bone marrow regeneration.***

- Bony union may fail to occur due to:
  (a) Faulty immobilization which leads to fibrous union.
  (b) Infection at the site of fracture.
  (c) Impairment of the blood supply.
  (d) Interposition of soft tissue between the bony ends.
  (e) Nutritional disturbance of the body and old age.

- **HEALING OF WOUNDS**
- **I. Primary Union of Wounds (Healing by First Intention):**
- Occurs in a clean incised wound with minimal tissue destruction, and when the edges are approximated e.g. surgical wounds.
  (1) The wound is filled by blood clots.
  (2) The basal cell layer of the epidermis on both edges of the wound proliferates across the clot to meet in the center, and then divides to form the whole thickness of the epidermis. The dermal adnexa do not regenerate. The remnants of the clot at the surface is called scab. The scab separates within 10-14 days.
  (3) The gap of the wound under the new epithelium gets filled by granulation tissue originating from both edges of the wound.
  (4) Maturation of granulation tissue to fibrous called scar.

- **II. Secondary Union of wounds (Healing by Second Intention):**
  Occurs in healing of gaping wounds or abscesses.
  (1) The gap of the wound is filled by blood clots.
  (2) The epidermal cells at the margins proliferate across the blood clot, they do not cover the wound until the gap gets filled with granulation tissue up to the level of the basal cell layer of the epidermis.
  (3) The basal cell layer proliferates to cover the formed granulation tissue and divides to form the whole epidermal thickness.
  (4) The granulation tissue matures to fibrous tissues, and the wound contracts by the action of
  myofibroblasts.

- **Complications of Wound Healing:**
  (1) ***Chronic ulcer:*** Is a persistent loss of continuity of the surface epithelium.
  (2) ***Sinus:*** A blind ended tract between the depth of a wound or cavity and the skin surface.
  (3) ***Fistula:*** A tract between the abscess cavity and a hollow organ or between two hollow organs.
  (4) ***Keloid:*** Large scar projecting on the surface and covered by stretched epidermis it is due to overdone repair.
  (5) ***Contraction:*** in a scar on a flexure may interfere with movement
  (6) ***Implantation (or epidermoid) cyst:*** Epithelial cells trapped in the wound and form an epidermoid cyst.
  (7) ***Squamous cell carcinoma*** rarely develops in a scar.
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