CHAPTER II.2.2

Inflammation, Wound Healing, and the Foreign-Body Response

QUESTIONS

1. For an implanted biocompatible biomaterial, identify the characteristic cell types and response duration of the following responses:
   a. Acute inflammation
   b. Chronic inflammation
   c. Granulation tissue
   d. Foreign-body reaction
   e. Fibrous capsule.
2. List the three classes of substances released by macrophages and foreign-body giant cells that facilitate the degradation of foreign materials.
3. Describe the process involved in the formation of foreign-body giant cells.
4. What growth factors increase fibroblast proliferation?
5. List four variables that can modulate the tissue responses to an implanted biomaterial.
6. What transient event in the sequence of host reactions to an implant is most closely related to coagulation and thrombosis?
7. What are the two most probable causes of finding chronic inflammation at the tissue/implant interface six weeks following implantation of a biomaterial?
8. What cell type and its product form the fibrous capsule?
9. What transient cell type is responsible for the contraction of wounds?
10. What two tissue/organ repair processes may take place at implant sites?
11. What cell death process promotes an inflammatory response?
12. What cell death process does not promote an inflammatory response?

ANSWERS

1. a. Polymorphonuclear leukocytes, 0–3 days
   b. Monocytes and lymphocytes, 3–7 days
   c. Infiltrating fibroblasts, new blood capillary formation, 7–21 days
   d. Macrophages and foreign-body giant cells, persistent
   e. Fibroblasts and collagen, persistent.
2. a. Oxygen radicals: ROIs – reactive oxygen intermediates, H_2O_2, superoxide anion, $O_2\bullet$, hydroxyl radical
   b. Enzymes
   c. Acid: pH between 3.5 and 7.2.
3. Monocytes migrate from blood vessels into the implant site and adhere to the surface of the implant where they differentiate into macrophages that fuse to form multinucleated giant cells.
4. Fibroblast proliferation is increased by PDGF, IFN-γ, TGF-β, FGF, EGF, IL-1, and TNF-α. At low concentrations, IFN-γ, TGF-β, and TNF-α increase fibroblast proliferation, but at high concentrations, IFN-γ, TGF-β, and TNF-α decrease fibroblast proliferation.
5. a. Extent of injury created upon implantation
   b. Size of implant
   c. Shape of implant
   d. Surface area of implant
   e. Topography of implant
   f. Chemical properties of the biomaterial
   g. Physical properties of the biomaterial.
6. Provisional Matrix Formation.
7. a. Infection
   b. Toxic biomaterial or its constituents.
8. a. Fibroblasts
   b. Collagen.
9. Myofibroblast.
10. a. Regeneration – replacement of injured tissue by parenchymal cells of the same type.
    b. Replacement – connective tissue formation, scar or fibrosis, to form the fibrous capsule.
11. Necrosis.
12. Apoptosis – programmed cell death.