Reticuloendothelial System and Tissue Macrophage

Chapter 24

DEFINITION AND DISTRIBUTION

RETICULOENDOTHELIAL SYSTEM OR MACROPHAGE SYSTEM

Reticuloendothelial system or tissue macrophage system is the system of primitive phagocytic cells, which play an important role in defense mechanism of the body. The reticuloendothelial cells are found in the following structures:

1. Endothelial lining of vascular and lymph channels.
2. Connective tissue and some organs like spleen, liver, lungs, lymph nodes, bone marrow, etc.

Reticular cells in these tissues form the tissue macrophage system.

MACROPHAGE

Macrophage is a large phagocytic cell, derived from monocyte (Chapter 17).

CLASSIFICATION OF RETICULOENDOTHELIAL CELLS

Reticuloendothelial cells are classified into two types:

1. Fixed reticuloendothelial cells or tissue macrophages.
2. Wandering reticuloendothelial cells.

FIXED RETICULOENDOTHELIAL CELLS – TISSUE MACROPHAGES

Fixed reticuloendothelial cells are also called the tissue macrophages or fixed histiocytes because, these cells are usually located in the tissues.

Tissue macrophages are present in the following areas:

1. *Connective Tissue*

Reticuloendothelial cells in connective tissues and in serous membranes like pleura, omentum and mesentery are called the fixed macrophages of connective tissue.

2. *Endothelium of Blood Sinusoid*

Endothelium of the blood sinusoid in bone marrow, liver, spleen, lymph nodes, adrenal glands and pituitary glands also contain fixed cells. Kupffer cells present in liver belong to this category.

3. *Reticulum*

Reticulum of spleen, lymph node and bone marrow contain fixed reticuloendothelial cells.

4. *Central Nervous System*

Meningocytes of meninges and microglia form the tissue macrophages of brain.

5. *Lungs*

Tissue macrophages are present in the alveoli of lungs.

6. *Subcutaneous Tissue*

Fixed reticuloendothelial cells are present in subcutaneous tissue also.

WANDERING RETICULOENDOTHELIAL CELLS AND TISSUE MACROPHAGES

Wandering reticuloendothelial cells are also called free histiocytes. There are two types of wandering reticuloendothelial cells:

1. *Free Histiocytes of Blood*

i. Neutrophils
ii. Monocytes, which become macrophages and migrate to the site of injury or infection.

2. *Free Histiocytes of Solid Tissue*

During emergency, the fixed histiocytes from connective tissue and other organs become wandering cells and enter the circulation.

FUNCTIONS OF RETICULOENDOTHELIAL SYSTEM

Reticuloendothelial system plays an important role in the defense mechanism of the body. Most of the functions of the reticuloendothelial system are carried out by the tissue macrophages.

Functions of tissue macrophages:

1. *Phagocytic Function*

Macrophages are the large phagocytic cells, which play an important role in defense of the body by phagocytosis.

When any foreign body invades, macrophages ingest them by phagocytosis and liberate the antigenic products of the organism. The antigens activate the helper T lymphocytes and B lymphocytes. (Refer Chapter 17 for details).

Lysosomes of macrophages contain proteolytic enzymes and lipases, which digest the bacteria and other foreign bodies.

2. *Secretion of Bactericidal Agents*

Tissue macrophages secrete many bactericidal agents which kill the bacteria. The important bactericidal agents of macrophages are the **oxidants.** An oxidant is a substance that oxidizes another substance.

Oxidants secreted by macrophages are:

i. Superoxide (O_2^-)
ii. Hydrogen peroxide (H_2O_2)
iii. Hydroxyl ions (OH^-).

These oxidants are the most potent bactericidal agents. So, even the bacteria which cannot be digested by lysosomal enzymes are degraded by these oxidants.

3. *Secretion of Interleukins*

Tissue macrophages secrete the following interleukins, which help in immunity:

i. Interleukin-1 (IL-1): Accelerates the maturation and proliferation of specific B lymphocytes and T lymphocytes.
ii. Interleukin-6 (IL-6): Causes the growth of B lymphocytes and production of antibodies.
iii. Interleukin-12 (IL-12): Influences the T helper cells.

4. *Secretion of Tumor Necrosis Factors*

Two types of tumor necrosis factors (TNF) are secreted by tissue macrophages:

i. TNF-α: Causes necrosis of tumor and activates the immune responses in the body
ii. TNF-β: Stimulates immune system and vascular response, in addition to causing necrosis of tumor.

5. *Secretion of Transforming Growth Factor*

Tissue macrophages secrete transforming growth factor, which plays an important role in preventing rejection of transplanted tissues or organs by immunosuppression.

6. *Secretion of Colony-stimulation Factor*

Colony-stimulation factor (CSF) secreted by macrophages is M-CSF. It accelerates the growth of granulocytes, monocytes and macrophages.

7. *Secretion of Platelet-derived Growth Factor*

Tissue macrophages secrete the platelet-derived growth factor (PDGF), which accelerates repair of damaged blood vessel and wound healing.

8. *Removal of Carbon Particles and Silicon*

Macrophages ingest the substances like carbon dust particles and silicon, which enter the body.

9. *Destruction of Senile RBC*

Reticuloendothelial cells, particularly those in spleen destroy the senile RBCs and release hemoglobin (Chapter 9).

10. *Destruction of Hemoglobin*

Hemoglobin released from broken senile RBCs is degraded by the reticuloendothelial cells (Chapter 11).