REVIEW OF MAST CELL PROGENITORS

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ABSTRACT

Mast cells are cells of immune systems which plays an major role in inflammatory responses such as hypersensitivity reactions. They are found in connective tissues of the body, especially below the surface of the skin, near blood vessels and lymphatic vessels, within nerves, throughout the respiratory system, and in the digestive and urinary tracts. These cells store a variety of different chemical mediators such as histamine, interleukins, proteoglycans (e.g., heparin), and various enzymes. When the mast cell activated by an by an allergen, the mast cells release the contents of their granules into the surrounding tissues. This process was named as Degranulation. This chemical mediators produce local responses characteristic of an allergic reaction, such as increased permeability of blood vessels (i.e., inflammation and swelling), contraction of smooth muscles (e.g., bronchial muscles), and increased mucus production. Mast cells are produced from the mast cell progenitors in the place of bone marrow by the process regulated by transcription factors. Based on the character of Surface markers the mast cells are characterized by flow cytometry. The centre of attraction of this review article was the origin and development of mast cell progenitors.

INTRODUCTION

In the Immune system Mast cells plays an important role. They are originated from pluripotent progenitor cells of the bone marrow, and they mature under the impact of the c-kit ligand and stem cell factor in the presence of other distinct growth factors provided by the microenvironment of the tissue where they are well defined to inhabit. Mast cells are present throughout the body and they take part in the maintenance of many physiological functions as well as in the pathophysiology of diseases.

Mast cells are mostly located in mucosal and epithelial tissues of the body. In rodents, mast cells also found in peritoneal and thoracic cavities. They are also found in all vascularized tissues except for the central nervous system and the retina. Mast cells are located at gastrointestinal tract, skin, respiratory epithelium.

To store the inflammatory mediators these cells contains 50–200 large granules which includes histamine, heparin, a variety of cytokines, chondroitin sulfate, and neutral proteases. The co-ordinated effects of integrins, adhesion molecules, chemokines, cytokines, and growth factors are necessary for the migration of mast cells to their target locations.

Human mast cells have two major Phenotypes: One is mucosal mast cells that produce only tryptase and another one is connective tissue mast cells which produce chymase, tryptase, and carboxypeptidases. Most common sites within the body exposed to antigens are the mucosa of the tract (airborne), alimentary canal (food borne), blood (wounds, absorption from respiratory tract/gastrointestinal tract), and connective tissues.

When the alimentary canal encounters an antigen, the fluid secretion, smooth contraction , and peristalsis has been increased. For the mast cells the Proteins derived from plants and animals can act as antigens and activate the system . This antigen (peptide) permeates through the epithelial layer of the mucosa of the gut and binds to IgE on mucosal mast cells. These antigenic peptides were presented to Th2 cells, and if the IgE antibody produced against that peptide, mastocyte activation has been occurred. By the response of this mast cells they release a spread of inflammatory mediators. These mediators increase vascular permeability, causing edema within the gut epithelium and smooth contraction , which cause vomiting and diarrhea.

The mastocyte activation within the tract , causes airway constriction, increased mucous production, and cough. The antigens mostly entered into the tract via inhalation. Some antigens diffuse across the mucosa which activates the nasal epithelium. The congestion was caused thanks to the rise of vascular permeability within the tract . It also causes the bacterial infection by increase the assembly of mucus and its accumulation. This accumulation block off the sinuses. Mast cells also play a pivotal role within the pathophysiology of allergic asthma. The inhalation of antigens get them into the lower tract and cause degranulation and native inflammation..

MECHANISM OF ACTIVATION

Mast cells plays an major role in IgE mediated allergic reactions through FcϵRI receptor. These antibodies are produced by mature B cells by the induction of CD4+ Th2 cells. The mature B cells produce IgM and IgD antibodies. These cells are activated only by antigens and proliferated by B cells. If the B cells interact with IL-4 the antibody changed from IgM to IgE. Most of the IgE antibodies are bound with FcϵRI receptors on the mast cell, only some of the IgE antibodies are soluble in circulation. When an antigen engaged with the mast cell, it crosslinks with two or more FcϵRI molecules and activates the release of granules from the mast cell. IgE molecules were found in the connective tissues, respiratory tracts, and also in the gastrointestinal tract. These mast cells also expresses Fc receptors for IgA and IgG antibodies, which are the receptors for adenosine, C3a, chemokines, cytokines, and pathogen-associated molecular patterns (PAMPs), as well as toll-like receptors (TLRs), all of which are involved in mast cell activation and immune response.

Physiological Roles of Mast Cells

Mast cells are used to regulate various physiological functions like vasodilation, angiogenesis, bacterial, and parasite elimination. In addition to this processes they also regulate the functions of many cell types, such as dendritic cells, macrophages, T cells, B cells, fibroblasts, eosinophils, endothelial cells, and epithelial cells. These Mast cells generate and release multi-potent molecules, which are named as histamine, proteases, prostanoids, leukotrienes, heparin, and many cytokines, chemokines, and growth factors. These factors have the ability to be involved in regulation of the functions of many organs and tissues. The most deliberated functions of the mast cell is its role in vascular and bronchial homeostasis. Mast cells also play a important role in the regulation of bone growth, remodeling, and mineral homeostasis.

Angiogenesis

The another main function of Mast cells was enhancing angiogenesis. They secretes a factor named as pro-angiogenic factors, such as VEGF, bFGF, TGF-beta, TNF-alpha, and IL-8. In addition, mast cells also release proteases and heparin which release pro-angiogenic factors that bind to heparin. To induce the

permeability of the microvasculature these cells produce histamine, that also induces angiogenesis. These mast cells also enhance angiogenesis in tumor growth.

Homeostasis

Mast cells also provide homeostasis in the immune system. Due to their location in skin and mucosa they serve as a first line of defense against antigens entering the body. They are especially important in the homeostasis of the commensal bacteria presented in the gut. The epithelial cells present in the digestive system serve as a barrier to the antigens which are constantly exposed during consumption of food.

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