



Review

MAST CELLS IN LUNG OF RAT

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ABSTRACT

This paper is a short review of scientific literature on lung mast cells in norm and pathology that shows the current state of this problem. Particular attention is paid to the quantity, location and arrangement of the mast cells. The mast cells are a part of immune system whom origin are myeloid stem cells. They are a kind of white blood cells. Many authors from the 19th century to the present day have traced and described the role of mast cells in the human body, their structure and changes depending on the functional state of the organism.

Paul Ehrlich is the first author that described in his doctoral thesis the mast cells as effectors of allergy particularly in the beginning of reaction and in acute phase of the process. Research has continued through out the 20th century and researchers' efforts are primarily focused on clarifying the structure and function of mast cells and identifying their role in pathological responses in the human body.

Mast cells are found in all organs, but they predominate in peripheral blood, spleen and bone marrow. There are cells in the rat skin that live for about 12 weeks, and more recent studies have found that proliferation of mature mast cells is caused by various factors.

Key words: mast cells, lung, proliferation, morphology

INTRODUCTION

The mast cells are a part of immune system whom origin are myeloid stem cells. They are a kind of white blood cells (1). Initially, their presence in the tissues was associated with an allergic reaction and the number of mast cells is up in response to infection by helminthes and protozoa, autoimmune and inflammatory disorders of the joints (2).

There are investigations of the role of mast cells for hypersensitivity (3). These authors describe the role of mast cells, basophils and eosinophils in this process.

There are some mast cells tumors that secrete products of degranulation. Some authors describe a mast cell activation syndrome (4).

PURPOSE AND TASKS

The **aim** of this study is to make a brief literary review of the morphological characteristics of the mast cells in relation with rat lung and its reaction in an emergency.

To accomplish this goal, we set out the following main **tasks**:

1. To review our available literature related to mast cell morphology.
2. To present contemporary articles those are related to lung mast cell research.
3. To establish the current state of lung-related studies of mast cells.

LITERARY REVIEW

Paul Ehrlich (5) is the first author that described in his doctoral thesis the mast cells as effectors of allergy particularly in the beginning of reaction and acute phase of the process. He and his followers studied the morphological features of mast cells and their physiological status in norm and pathology. Ehrlich describes mast cells as metachromatic cells containing granules that are functionally related to surrounding tissues.

Some authors (6, 7) described the histamine as functionally active mast cell mediator in rats. Other published the content of granules in mast cells (8). The synthesis of histamine is a process of histidine decarboxylation under the impact of enzyme histidine decarboxylase (9, 10).

The similarity between mast cells and basophil granulocytes is supported by many authors (11, 12, 13). After experiments on cell cultures they

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demonstrate the truth of the role of interleukin 3 as a growth and differentiation factor for mouse mast cells.

There are investigations (14) of the hematopoietic origin of the mast cells in rodents. These authors implant bone marrow from domestic white mice (C57Bl Bg^J/ Bg^J) into wild mice (type C57Bl). Large granules of wild mice mast cells appear into the mast cells of recipient domestic mice. These authors reach a conclusion that mast cells derive from precursor cells of bone marrow and they are changed under the influence of wild mice marrow Jamur et al. (15) use a method of immunomagnetic isolation with two kinds of mast cell specific antibodies (mAb AA4 and mAb BGD6) and isolate a mast cell committed precursor MCcp (CD34⁺CD13⁺c-Kit⁺FcεRI⁺) from the bone marrow of adult mice.

The same team use mast cell specific monoclonal bodies for identification and isolation of rat bone marrow-derived mast cells (16).

In recent times, researchers' efforts have been directed towards revealing the molecular mechanisms of fat cell action (17) and the mechanisms of release and secretion pathways of mast cell mediators (18). These authors described two kinds of degranulation in human, rats and mouse. In PMD (piecemeal degranulation) process mediator is released in portions without membrane fusions. In AND (anaphylactic degranulation) process there is an explosive release of mediator after granule membrane fusion.

Ashmole and Bradding (19) investigate the importance of ion channels for the regulation of cell biology. They ascertain the fact that cation channels are activated by extracellular ATP and its concentration is presented around mast cells in inflamed tissues. P2X are ligand-gated receptors and they conduct Ca²⁺ influx into mast cells. Different P2X receptors mast cells may be able to tailor their response to ATP in a concentration dependent manner.

After biochemistry investigation some authors described that except allergic reactions mast cells are involved in angiogenesis and immune tolerance, the cerebro-vascular barrier, and in the protection against many pathogenic factors (20). These authors described that mast cells use different mechanisms for recognition of pathogenic factors.

According Polyzoidis et al. (21) mast cells are located in various regions of the brain. These authors described numerous granules that

secrete mediators like CRH (corticotropin-releasing hormone), SP (substance P), NT (neurotensin), VIP (vasoactive intestinal peptide), prostaglandins, leucotriens etc. chemokines and cytokines are described in mast cell secretion too.

Mast cells are present in lung of human and rat. They are located in two places. Fixed mast cells are found in epithelium of lung and free mastocytes are in the bronchial lumen (22). The mediators of these cells are in the base of some pulmonary diseases symptoms: smooth muscle constriction, mucus production, edema and cough.

Most of investigators described the state of mast cells in connection with pulmonary diseases (23) but they declare that mast cells play an important role in the lung in both health and disease. According these authors mast cells are important for immunity against bacterial infection and to initiate an appropriate program of inflammation.

New investigations in last years search a connection between mast cells in the lung as a culprit and respiratory disorders (24, 25). The same author suggests that in vitro mast cell models are a future possibilities in the investigations. He release his results of immunohistochemical identification of tissue mast cells and identification of tissue mast cells by flow cytometry.

CONCLUSIONS

A great part of the current knowledge on the mast cells has been gained by the culture of mouse BMMCs in vitro in the presence of growth factors. Some investigators agree that IL-3 favors the development of a mucosal mast cell phenotype in vitro (2) but they are critical for the development of murine BBMCs in vivo.

Two subtypes of mature mast cells have been described in rodents: mucosal mast cells (MMCs) and connective tissue mast cells (CTMCs) (27). In mouse, MMCs is described in the mucosal epithelium of the lung and gastrointestinal tract. The protease content of mouse mast cells is characterized by chymases mMCP-1 and mMCP-2 that are found to chondroitin sulfate chains of serglycin proteoglycans.

The literary review presents that the publications for mast cells are numerous but most of investigations for mast cells in lung are clinically. Theoretical observations are not too frequent. This is a reason for realization of this studying.

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