Role of Mast Cell in Oral Pathology

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ABSTRACT

In oral tissues, the mast cell releases various pro-inflammatory cytokine tumor necrosis factor alpha (TNF-α) which stimulate leukocyte infiltration in various inflammatory condition of oral cavity such as oral lichen planus (OLP), periapical lesions, gingivitis & periodontitis. Mast cells are the local residents of the connective tissue and plays an important role in immunopathology and producing mitogenic cytokines. These cells plays a role in pathogenesis of oral diseases.

Keywords: Oral Pathology, Inflammatory.

INTRODUCTION

Mast cells are granulated cells and appears as a large spherical cells which is present in all of the connective tissue elements including skin, submucosa or connective tissue of various organs and mucosal epithelial tissues & also in dental pulp1,2. Life span of weeks to months. It is derived from bone marrow and it contains granules granules are rich in heparin, chondroitin sulphate, proteoglycan and numerous enzymes including collagenase. These granules are metachromatic in nature and it is confirmed with staining such as Toludine blue.

Ultrastructure of Mast Cell

Three types of mast cell
1. In deeper connective tissue, the cells (except that in close vicinity to blood vessels) appears as round /oval in shape & dark purple in colour. The borders of cell are well defined & nucleus is not visible due to granules called as intact cells3

2. In the superficial connective tissue, the mast cells appear flattened / irregular and the cytoplasm appears granular immediately below the infiltrate area and near the blood vessels. The cell borders are not defined and the nucleus is only partially appreciable; these are called spreading cells4.

3. The third type called degranulated cells found within the infiltrate & appeared paler the staining has reverted from metachromatic violet to light pink, the nucleus blue in color and well defined5.

Role of mast cell released cytokines

IL-3 – induce basophil recruitment & activation
IL-5-eosinophil recruitment & activation
IL-13 – induction of IgE synthesis

Mast cell bears receptors for IgE and degranulates this cytophilic antibody is cross-linked by antigen. Mast cell RANTES degranulation can be caused by other factors such as mechanical trauma, complement C5a, eosinophil-derived cationic protein, and bacterial products. In the
absence of IgE mediated activation the mast cell can produce inflammation and its events under many conditions.

Thus, mast cell release proinflammatory mediators, promotes inflammation and angiogenesis, extracellular matrix degeneration and tissue remodeling.

Role of MC in Oral Pathologies

1. Role of MC in OLP:
   **Mechanism:**
   
   RANTES activation
   
   Mast Cells chemotaxis and degranulation
   
   TNF-Ü
   
   Endothelium cell adhesion molecule expression (Cd62 E, CD54, CD106)
   
   Chymase activation
   
   MMP-9 activation
   
   Disruption of basement membrane
   
   Keratinocyte apoptosis
   
   Intra epithelial CD 8
   
   T-cell migration through BM
   
   Survival of inflammatory cell
   
   Non-specific T-cell recruitment

   Action of mast cell mediators in oral lichen planus leading to the following clinical and histopathological changes

2. Action of mast cell mediators in oral submucous fibrosis leading to the following clinical and histopathological changes

3. Role of MC in angiogenesis in oral squamous cell carcinoma:

   Action of mast cell mediators in oral squamous cell carcinoma leading to the following clinical and histopathological changes

4. Role of MC in oral leukoplakia:

   Action mast cell mediators in oral leukoplakia leading to the following clinical and histopathological changes

5. Role of MC in Periapical lesions:

   **Mechanism:**
   
   MC releases
   
   Histamine
   
   Increase vascular permeability of small blood vessel

6. Role of MC in Pyogenic Granuloma:

   MC + neuropeptides neural immune network with LC in mucosal tissue
   
   Degranulation of MC
   
   Cytokine, vasoactive amine and enzyme
   
   Inflammatory and vascular changes
   
   Pyogenic granuloma

7. Role of MC in wound healing:

   Wound healing is a dynamic process consisting of four phases:

   - Increased inflammatory associated stress tissue due to hypoxia
   - Injury persists
   - Fibrosis of fibroblast
   - Mucosal proliferation or accumulation
   - New formation
### Table 1:

<table>
<thead>
<tr>
<th>Mediators</th>
<th>Clinical features</th>
<th>Histopathologic features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Histamine.</strong> Induces vasopermeability...</td>
<td>Vesicles, bullae and erosive lesions</td>
<td>Submucosal edema.</td>
</tr>
<tr>
<td>Antigen induced T-cell proliferation Inhibits the neutrophil...</td>
<td>Chronic persistence of the lesion.</td>
<td>Trafficking of T-lymphocytes.</td>
</tr>
<tr>
<td>Induces increased expression of E-selectin, ICAM and ICAM, whichcauses</td>
<td></td>
<td></td>
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<tr>
<td>leukocytic margination</td>
<td></td>
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<tr>
<td><strong>TNF-alpha.</strong> Increased production of matrix metalloproteinases like stromyelins, collagenase.</td>
<td></td>
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<tr>
<td>Destruction of basement membrane</td>
<td></td>
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<td><strong>Table 2:</strong></td>
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<td>Clinical features</td>
<td>Histopathologic features</td>
</tr>
<tr>
<td><strong>Prostaglandins and leukotrienes</strong></td>
<td>- Excessive salivation.</td>
<td>Submucosal edema</td>
</tr>
<tr>
<td>Increase the mucous gland secretion Increased venous permeability</td>
<td></td>
<td></td>
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<tr>
<td><strong>Histamine</strong> Causes vasodilatation and vasopermeability.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heparin.</strong> Causes vasoproliferation.</td>
<td>Petechiae</td>
<td>In early stages of oral submucous fibrosis consists of inflammatory infiltrate eosinophils</td>
</tr>
<tr>
<td><strong>Interleukin-5.</strong> Causes growth and differentiation of eosinophils</td>
<td>Itching sensation.</td>
<td></td>
</tr>
<tr>
<td><strong>Eosinophilic chemotactic factor (ECF)</strong> Causing eosinophilic migration</td>
<td></td>
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<tr>
<td><strong>Interleukin-1.</strong> Stimulates fibroblastic proliferation.</td>
<td>Decreased mouthopening</td>
<td>Increased collagen fiber bundles.</td>
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<td><strong>Table 3 :</strong></td>
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<td>Mediators</td>
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<td><strong>IL-1 AND TNF-alpha.</strong> Causes increased epithelial cell proliferation..</td>
<td>Exophytic growth or a plaque</td>
<td>Increased thickness of the epithelium</td>
</tr>
<tr>
<td><strong>Heparin.</strong> Causes angiogenesis and type-VIII</td>
<td>Tumour angiogenesis</td>
<td>Increased vascularity of the stroma.</td>
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</table>
Table 4:

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<tr>
<td>Histamine. Enhances permeability across the epithelial surface. Antigen induced T-cell proliferation.</td>
<td>Chronicity of the lesion</td>
<td>Increased mucosal permeability despite hyperkeratosis</td>
</tr>
<tr>
<td>Heparin. Causes endothelial cell proliferation and migration</td>
<td>Erosive leukoplakia.</td>
<td>Increased vascularity of the stroma and ulceration</td>
</tr>
<tr>
<td>Interleukin-1 and TNF. Increased epithelial cell proliferation.</td>
<td>White patch or a plaque</td>
<td>Increased thickness of the epithelium</td>
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</table>

a. Homeostasis
b. Inflammation
c. Proliferation
d. Tissue remodeling and resolution

**Wound healing**

Wound healing involves degradation, cell migration, synthesis of fibronectin, fibrin and high amount of collagen type II and matrix remodeling to return the tissue to normality.

III. MMP – 9 from mast cell  
Wound healing

8. Role of mast cell in peripheral ossifying fibroma  

CONCLUSION

This article mainly focus that all oral reactive lesions have MCs, thus having a possible role in pathogenesis of these lesions. In recent years, Mast cells have gained a lot of importance owing to the vast number of chemical mediators released by them with wide range of actions in various disease processes. Once confirmed, it makes easier for us to target the therapeutic modalities against mast cells and the granules it contains to alter the course of disease/lesion.

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