Mast Cell Count Analysis in Oral Inflammatory Lesions, Potentially Malignant Disorders and Oral Squamous Cell Carcinomas

Banavar Ravi Spoorthi*, Gurram Shankar Vidya**

* Reader, ** Post Graduate Student, Department of Oral Pathology, MS Ramaiah dental College, Bangalore.

ABSTRACT

Background: Mast cells have been studied for decades due to their prominent role in normal homeostasis and various pathologies. They display a diversity of roles and are proposed to be a part in the pathogenesis of various pathologic lesions.

Aims and Objectives: To histologically evaluate the number of mast cells in tissue sections of oral inflammatory lesions, potentially malignant disorders and oral carcinomas.

Methodology: 10 cases each of inflammatory lesions, potentially malignant disorders and carcinomas were considered. Tissue sections were stained with H&E to confirm the diagnosis & 1% toluidine blue for evaluation of mast cells. Cells were counted manually in a stepladder fashion and were expressed as an average number of mast cells per 30 high power fields.

Results: Inflammatory hyperplasia among the inflammatory lesions and lichen planus among the potentially malignant disorders showed an increase in number of mast cells. While oral Squamous cell carcinoma showed an average of 48 cells/ 30 high power fields.

Conclusion: These results suggest that there is significant evidence on the presence and increase in the number of mast cells supporting the biologic effect these cells have on the individual lesions.

Index terms- mast cells, potentially malignant disorders, precancerous lesions, oral cancer

INTRODUCTION

Paul Ehrlich, was the first scientist to visualize and describe mast cells, and named it as Mastzellan"- a well fed cell.[1] They are mobile, bone-marrow-derived, granule-containing immune cells that are found in most of the environments, including the oral cavity, specially the dental pulp. They are distributed preferentially about the microvascular bed, close to the basement membranes of vascular endothelial cells and nerves in tissues such as oral mucosa and skin. [2] At the light microscope level, the secretory granules of mast cells give a characteristic metachromatic staining pattern with toluidine blue.

Mast cells display a diversity of roles in extracellular matrix degradation, angiogenesis and innate and acquired immune responses, due to their ability to release a range of pre-formed mediators, including cytokines, vasoactive amines, and enzymes on activation. [2-3] Mast cells have been studied for decades due to their prominent role in normal homeostasis and various pathologies.[4] Volumes of literature exist on the proposed role of mast cells in the pathogenesis of various pathological conditions. Hence we wanted to histologically evaluate the number of mast cells in tissue sections of oral inflammatory lesions, potentially malignant disorders and oral carcinomas.

MATERIALS AND METHODS

10 cases each of inflammatory lesions, potentially malignant disorders and carcinomas were randomly chosen from archival [year 2008-2012] collection of Department of Oral Pathology, M S Ramaiah Dental College and Hospital, Bangalore, Karnataka [Table 1].

All the above tissue sections were stained with H&E to confirm the diagnosis & 1% toluidine blue to study the mast cell. Toluidine blue stains mast cell granules purplish red and nuclei sky blue in colour. Mast cells were counted manually in 30 high-power fields under a magnification of 40x in a stepladder fashion [fig 1]. Mast cells were expressed as an average number of mast cells per 30 high power fields [table 2].

RESULTS

On comparison within the group of lesions [table 2], inflammatory hyperplasia among the inflammatory lesions and lichen planus among the potentially malignant disorders showed an increase in number of mast cells. While oral squamous cell carcinoma showed an average of 48 cells/ 30 high power fields.

DISCUSSION

Among the inflammatory lesions that we considered, the average no of mast cells per 30 high power fields were increased in inflammatory hyperplasia followed by pyogenic granuloma and periapical granuloma. In potentially malignant disorders, lichen planus showed an increase number of mast cells; an average of 58/30 hpf followed by oral submucous fibrosis. Leukoplakia showed the least number of mast cells among the three oral potentially malignant disorders. Oral squamous cell carcinoma showed an average of 48 cells/ 30 high power fields on comparison with OSMF, leukoplakia and periapical granuloma.

Table 1: Distribution of cases of inflammatory lesions, potentially malignant disorders and carcinomas

Inflammatory lesions		Potentially malignant disorders		Carcinoma	
Periapical granuloma	4	Lichen planus	3	Squamous cell carcinoma	10
Pyogenic granuloma	3	Leukoplakia	3		
Inflammatory hyperplasia	3	Oral submucous fibrosis	4		

Table 2: Analysis of mast cell count in toluidine blue stained slides

Lesions	Cases	Average no of mast cells/ 30hpf
Inflammatory lesions		
Inflammatory hyperplasia	3	55.3
Pyogenic granuloma	3	48
Periapical granuloma	4	36
Potentially malignant disorders		
Lichen planus	3	58
Leukoplakia	3	41
OSMF	4	43.5
Oral squamous cell carcinoma		
Squamous cell carcinoma	10	48

Thus these results suggest that there is significant evidence on the presence and increase in the number of mast cells supporting the biologic effect these cells have on the individual lesions.

Rakesh et el, conducted a study to evaluate the total mast cell count and the number of degranulated mast cells among 40 confirmed cases of oral leukoplakia on comparison with normal gingiva. They obtained a statistically significant rise of mast cells in leukoplakia and stated that this may be attributed to the pro-inflammatory and pro-angiogenic role in oral leukoplakia and which may actually play a significant role in its progression to invasive carcinoma. [5]

Sabrinath et al in their study showed a definite increase in the mast cell density in different grades of OSMF immunohistochemically and hence revealed their role in pathogenesis characterized by early progressive fibrosis and failure of degradation and remodeling in advanced stages. [6]

Mast cell role in pathogenesis of lichen planus is well established and proved. Our findings are consistent with studies done by Rachna Sharma et al,[7] Sumairi Ismail et al [8] and Sugerman et al, who also made a note of its role in pathogenesis. [9]

Mast cells have been implicated in promoting angiogenesis. Recent studies in solid malignant tumors suggests that mast cells play a role in tumor angiogenesis and mast cell density appears to be a reliable prognostic marker. Several angiogenic factors have been found in mast cells, especially tryptase which was found to be a potent angiogenic factor.

Studies done by Anak Iamaroon et al, [10] Elpek et al, [11] have shown statistically significant increase in mast cell count in SCC in their studies and concluded that they have a role in angiogenesis and hence might be responsible of the aggressive behavior of these lesions.

In contrast to the above finding was, a study conducted by Helenesa Helena et al where the mast cell count was

considerably low and was related to the related migration failure of these cells, possibly reflecting an important modification in the microenvironment during tumor initiation and progression.[3]

Mast cells are phylogenetically old cells, distributed throughout the human organism and which on a whole occupy roughly the volume of the spleen. There is growing evidence that these cells exert distinct non-immunological functions, playing a relevant role in tissue homeostasis, remodeling and fibrosis as well as in the processes of tissue angiogenesis. [12]

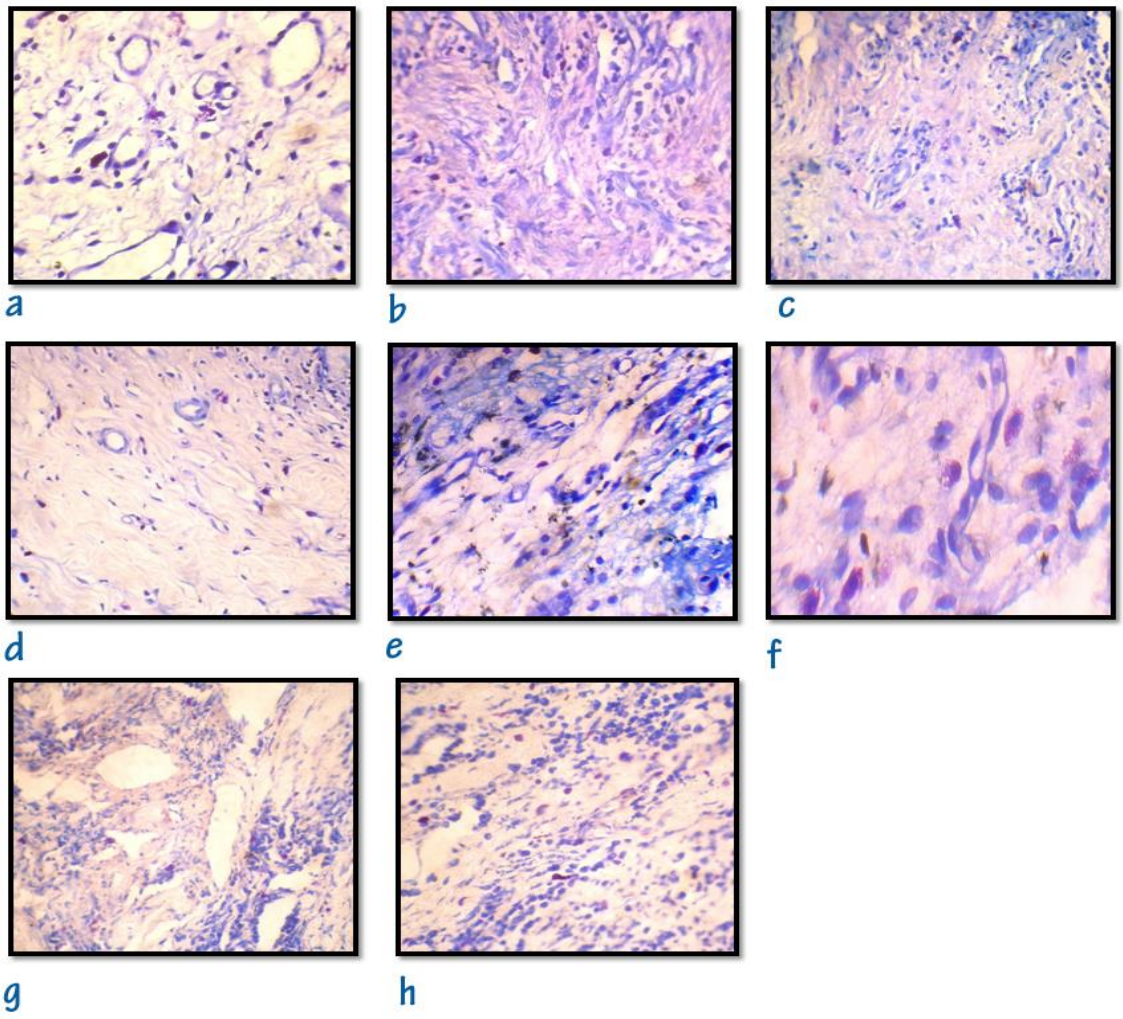
The significance of the distribution of mast cells in tissue compartments relates to the potential for mast-cell-derived mediators to influence nearby cells, with resulting stimulatory, inhibitory or toxic effects. These cells on activation, induced by a range of stimuli such as cold temperatures, medications, exercise, antigens, neuropeptides etc may either undergo explosive degranulation or piecemeal degranulation (release solitary granules on an ongoing basis).[2] Following this they are deposited in large quantities in the extracellular environment, where they exert effects on endothelial cells and other cell types.

Mast cells have long been recognized as potent producers of a large panel of biologically highly active mediators but most of their biological functions have been elusive and speculative. [13] Volumes of previous literature have evolved pertaining to the distribution and the role of mast cells in the development of oral lesions.

CONCLUSION

Mast cells are of the hematopoietic lineage that plays an important role in pathogen surveillance. They are the powerhouses of biologic factors and ideally poised to serve as "gatekeepers" of the microvasculature in the oral cavity. Hence its presence in oral lesions is attributed towards a role in their pathogenesis.

Figure 1: Mast cells in toluidine blue stained sections of different oral lesions under 10x magnification. a-pyogenic granuloma, b-periapical granuloma, c- inflammatory hyperplasia, d-Lichen planus, e- OSMF, f- leukoplakia(40x magnification), g and h - OSCC



BIBLIOGRAPHY

1. Abraham, S. N., & John, A. L. S. Mast cell-orchestrated immunity to pathogens. Nature Reviews Immunology 2010; 10(6): 440-452.
2. Walsh, L. J. Mast cells and oral inflammation. Critical reviews in oral biology & medicine 2003; 14(3):188-198.
3. Oliveira-Neto, H. H., Leite, A. F., Costa, N. L., Alencar, R. C., Lara, V. S., Silva, T. A., et al. Decrease in mast cells in oral squamous cell carcinoma: possible failure in the migration of these cells. Oral oncology 2007; 43(5): 484-490.
4. Ankle, M. R., Kale, A. D., & Nayak, R. Mast cells are increased in leukoplakia, oral submucous fibrosis, oral lichen planus and oral squamous cell carcinoma. Journal of Oral and Maxillofacial Pathology 2007; 11(1):18-22.
5. Rakesh S, Vidya M, Janardhanan M, Vinodkumar R.B, Savithri Vindhya. Analysis of mast cell counts in oral leukoplakia. Oral & Maxillofacial Pathology Journal 2012; 3(1) 181-184.
6. Sabarinath, B., Sriram, G., Saraswathi, T. R., & Sivapathasundharam, B. Immunohistochemical evaluation of mast cells and vascular endothelial proliferation in oral submucous fibrosis. Indian Journal of Dental Research 2011; 22(1):116-121.
7. Sharma, R., Sircar, K., Singh, S., & Rastogi, V. (2011). Role of mast cells in pathogenesis of oral lichen planus. Journal of oral and maxillofacial pathology: Journal of oral and maxillofacial pathology 2011; 15(3): 267-271.
8. Ismail, S. B., Kumar, S. K., & Zain, R. B. Oral lichen planus and lichenoid reactions: etiopathogenesis, diagnosis, management and malignant transformation. Journal of Oral Science 2007; 49(2):89-106.
9. Sugerman, P. B., Savage, N. W., Walsh, L. J., Zhao, Z. Z., Zhou, X. J., Khan, Aet al. The pathogenesis of oral lichen planus. Critical Reviews in Oral Biology & Medicine 2002; 13(4): 350-365.
10. Iamaroon, A., Pongsiriwet, S., Jittidecharaks, S., Pattanaporn, K., Prapayasatok, S., & Wanachantararak, S. Increase of mast cells and tumor angiogenesis in oral squamous cell carcinoma. Journal of oral pathology & medicine 2003; 32(4):195-199.
11. Elpek, G. Ö., Gelen, T., Aksoy, N. H., Erdoğan, A., Dertsiz, L., Demircan, A., & Keleş, N. The prognostic relevance of angiogenesis and mast cells in squamous cell carcinoma of the oesophagus. Journal of clinical pathology 2001; 54(12):940-944.
12. Crivellato, E., Beltrami, C. A., Mallardi, F., & Ribatti, D. The mast cell: an active participant or an innocent bystander? Histol. Histopathol. 2004; 19: 259–270.
13. Theoharides, T. C., & Cochrane, D. E. Critical role of mast cells in inflammatory diseases and the effect of acute stress. Journal of neuroimmunology, 2004; 146(1):1-12.

AUTHORS

First Author – Banavar Ravi Spoorthi, MDS, Reader , Oral Pathology, MS Ramaiah dental College, e mail- drspoorti@gmail.com **Second Author** Gurram Shankar Vidya, Post graduate student, Oral Pathology, MS Ramaiah dental College, e mail-

Correspondence Author – Banavar Ravi Spoorthi, MDS, Reader , Oral Pathology, MS Ramaiah dental College, e mail- drspoorti@gmail.com , contact no- +91 9742980076