Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2016;6:1:157-163.

Mast Cells: In Periapical and Periodontal Lesions

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ABSTRACT

Aim & Objectives: The present study was conducted to quantify Mast cells in Periapical and Periodontal lesions thus to assess the role of Mast cells in pathogenesis of these lesions.

Materials and Method: A total number of 60 cases of periapical lesions and periodontal lesions, 30 in each group respectively were taken. 15 cases of clinically healthy gingival tissues were selected. Specimens processed and Serial sections of 4 micron thickness were made. One section stained with routine Hematoxylin & Eosin staining to confirm the clinical diagnosis and another section was stained with toluidine blue for demonstration of mast cells. Ten microscopic fields were selected for counting of mast cells. Mast cells were counted under higher magnification (400X) using vernier scale and then totaled to obtain the mean value. Data was statistically analyzed by using student's t test.

Results: In the present study, Mast cells are found to be more numerous in the periapical cysts than periapical granulomas. In case of periodontal lesions the number of mast cells increased with increasing degree of inflammation. We found highest number of mast cells in severe inflammation as compared to mild to moderate inflammation.

Conclusion: Presence of increased number of mast cells in these lesions suggests an active role of mast cells in the pathogenesis of these lesions.

Keywords: Mast cells, Periapical cyst, Toluidine Blue.

INTRODUCTION

The periapical inflammatory lesion is the response of the periapical tissues to microbial and chemical stimuli coming from the pulp through the root canal systems that are able to elicit an immunologic reaction. The periapical granuloma and radicular cyst can be considered as most important periapical lesions, which can be associated in teeth with necrotic pulp or improper root canal therapy. Macrophages, lymphocytes, plasma cells, fibroblasts, endothelial cells, and mast cells (MCs) are involved in the pathogenesis of the inflammatory periapical lesions.[1] Several works quantified the inflammatory cell content in periapical lesions. The role of almost all the inflammatory cells present in the periapical

Received: Sept. 11, 2016: **Accepted:** Nov. 1, 2016
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pISSN 2278-0076
eISSN 2321-9270

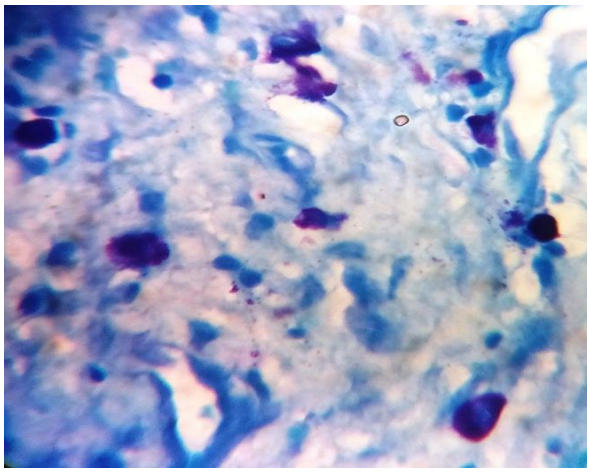

Fig 1: Mast cells in Periapical Granuloma (1000x Magnification Toluidine blue stain).

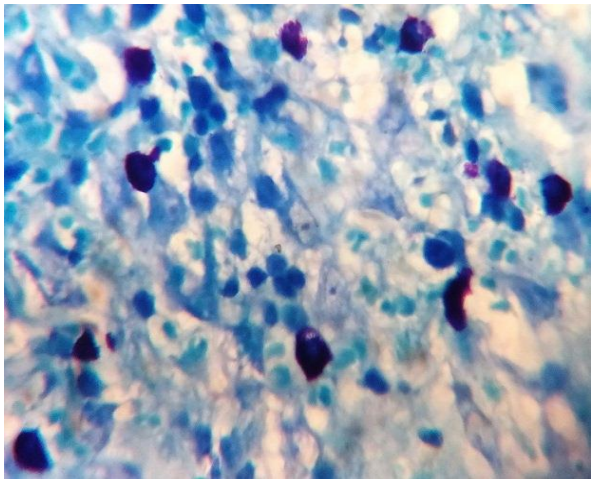

Fig 2: Mast cells in Radicular cyst (1000x Magnification Toluidine blue stain).

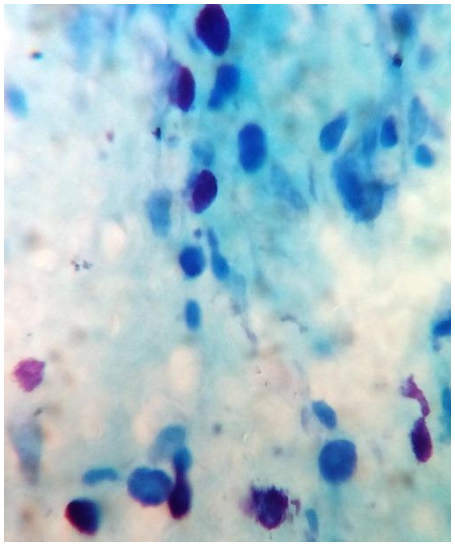

Fig 3: Mast cells in Gingivitis (1000x Magnification Toluidine blue stain) (mild inflammation)

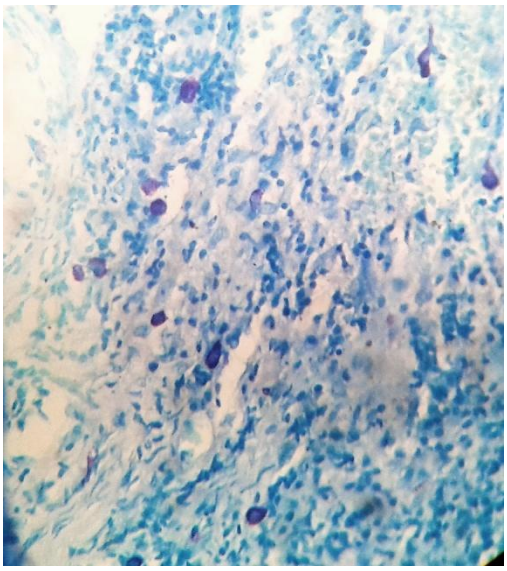

Fig 4: Mast cells in Periodontitis (400x magnification Toluidine blue stain) (Moderate to severe inflammation)

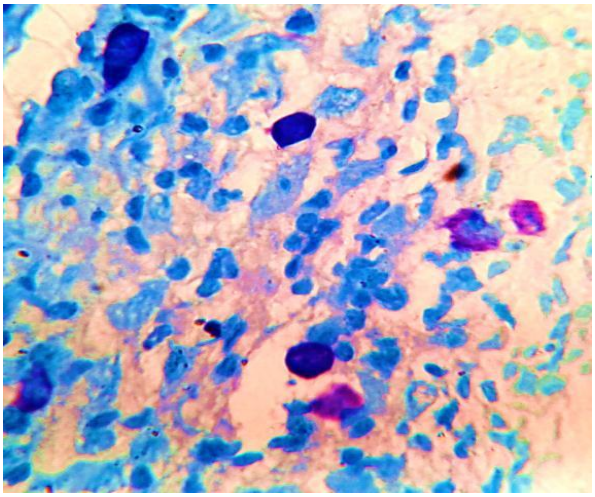

Fig 5: Mast cell in Periodontitis (1000x Magnification Toluidine blue stain) (Moderate to severe inflammation).

reactions and their role in the pathogenesis of the periapical granulomas has also been well studied, but the role of the Mast Cells in the development of the human periapical inflammatory lesions has been less studied.

To know the exact pathogenesis of the disease is the first step to prevent any disease and this applies to periodontal diseases also. Periodontitis is one of the most common inflammatory oral diseases triggered by bacteria in dental plaque. There are evidences which proved that certain immune and inflammatory responses

definitely act as a destructive mechanism in periodontal disease process .Release of mast cell mediators may be responsible for periodontal breakdown. Among the cells found in the periodontal tissues, mast cells have been detected in both healthy and inflamed gingiva, in different numbers at various sites.[2]

The role of mast cell mediators to tissue damage and propagation of inflammatory responses make the control of mast cell activity important for the management of many inflammatory diseases. Because of discrepancies in various studies, limited attention and insufficient knowledge about the precise role of mast cells in periapical and periodontal lesions, the present study is undertaken to examine the relationship between, mast cell counts in periodontal and periapical lesions.

The Aim of this study was to quantify the mast cells in periapical and periodontal lesions and thus to assess the role of mast cells in the pathogenesis of these lesions.

MATERIALS AND METHODS

A total number of 60 cases of periapical lesions and periodontal lesions, 30 in each group respectively were taken. 15 cases of clinically healthy gingival tissues were selected from the patients who reported to the various departments of Chhattisgarh Dental College & Research Institute, Rajnandgaon. *In the Periapical group*, *15 cases of periapical granuloma* and *15 cases of Radicular cyst* were assessed. The specimens were cases of periapical radiolucent lesions associated with the radicular areas of carious teeth which were surgically excised. Specimens were also obtained from tooth extraction as a soft tissue attached with the root apex of the carious tooth.

In periodontitis group, tissue sample was obtained from patients undergoing periodontal surgery, as a part of their routine periodontal treatment (crown lengthening, and full-thickness mucoperiosteal flap/debridement). The American Academy of Periodontology guidelines were followed for classification of the periodontal disease and conditions.

1. *Fifteen samples with plaque - induced gingivitis* (PD < 3 mm and CAL < 1 mm with bleeding on probing)

2. *Fifteen samples with moderate to advanced Chronic Periodontitis* (PD and CAL > 4 mm with bleeding on probing).

In Control group- Ten samples with periodontally healthy tissues (PD<3 mm with no bleeding on probing) were assessed. Cases of tumors, Orofacial Granulomatosis, Gingival polyps, all types of gingival enlargements as well as systemic disease associated gingival and periodontal lesions were excluded from the study. The archival wax blocks of previously diagnosed cases of periapical and periodontal lesions, in the Department of Oral pathology & Microbiology, Chhattisgarh Dental College & Research Institute, Rajnandgaon, were also included in the study.

Hematoxylin & Eosin staining was done to confirm the clinical diagnosis. In cases of periapical lesions, through H & E staining the cases of radicular cyst and periapical granuloma were confirmed .In cases of periodontal lesions, the degree of inflammatory infiltrate was assessed , under 100x and 400x magnification.

The inflammatory infiltrate was scored (per 100x magnification field) (Table 1) as 0-1 when the no inflammatory cells were located or isolated inflammatory cells less than 10 were seen. 1-2 when isolated inflammatory cells as well as aggregates of inflammatory cells were seen in lamina propria only. The inflammatory infiltrate was scored as 2-3 when aggregates of inflammatory cells in the lamina propria only, associated with intraepithelial lymphocytes. The inflammatory infiltrate was scored as 3 when aggregates of inflammatory cells were seen throughout the connective tissue associated with intraepithelial lymphocytes. Sections were stained with toluidine blue for demonstration of mast cells. Each section was examined twice under binocular microscope (Olympus light microscope) under different magnifications (100X & 400X), by two observers .Mast cells were counted in two zones, subepithelial zone and deep connective tissue zone .Ten microscopic fields were selected for counting of mast cells, depending upon the density of the mast cells under low power magnification .Mast cells

were counted under higher magnification (400X) using vernier scale then totaled to obtain the mean value. (Figures 1-5)

Statistical analysis: The results of mast cells were expressed as mean ± s. d. of n observations per mm2. Also the comparative analysis of the number of mast cells/mm2 between periapical lesions and control group as well as between periapical granuloma and radicular cyst was performed. The comparison of number of mast cells between periodontally healthy and diseased group was also performed. The data was statistically analyzed using Student's *t*-test. A *P* value of less than 0.05 was considered statistically significant.

RESULTS

Table two shows comparison of mean values of quantification of mast cells in periapical granuloma and control group .The mean value of control group is in between 4.60 and 11.30 ± standard deviation 1.26 and 5.79 mast cells /mm^2 whereas mean value of periapical granuloma group is in between 15.00 and 30.20 ± standard deviation 2.51 and 10.02± mast cells /mm^2.As the p<0.01, there is highly significant difference in between periodontally healthy (control) and periapical granuloma group. Table three shows comparison of mean values of quantification of mast cells in radicular cyst and control group. As the p<0.01, there is highly significant difference in between periodontally healthy (control) and radicular cyst group.

Table four shows comparison of mean values of quantification of mast cells in periapical granuloma group and radicular cyst group. Here the p value is taken as:

.05- Significant at 5%, .01- Significant at 1% & NS- Not Significant

Three results showed not significant p value suggesting that there is no significant difference between the mast cell counts of radicular cyst and periapical granuloma. But rests of the results are statistically significant suggesting that there is significant difference between the mast cell counts of radicular cyst and periapical granuloma. Table five shows comparison of mean values of quantification of mast cells in control group (periodontally healthy) and gingivitis group. The mean value of control group is between 4.60 and 11.30 ± standard deviation 1.26 and 5.79 mast cells /mm^2 whereas mean value of gingivitis group is in between 12.20 and 15.30 ± standard deviation 3.39 and 7.12 mast cells /mm^2.As the p<0.01, there is highly significant difference in between periodontally healthy (control) and gingivitis group.

Table six shows comparison of mean values of quantification of mast cells in control group and periodontitis group. As the p<0.01, there is highly significant difference in between periodontally healthy (control) and gingivitis group

Table seven shows comparison of mean values of quantification of mast cells in gingivitis group and periodontitis group. As the p<0.01, there is highly significant difference in between periodontitis group and gingivitis group.

DISCUSSION

A Mast cell (also known as Mastocyte or Labrocyte) is derived from myeloid stem cell and is a part of immune system. Mast cells play important role in mucosal inflammation, host defense and tissue repair.[3, 4, 5] Mast cells are also known as "unicellular endocrine glands" due to their ability to release a wide variety of chemical mediators like histamine and heparin. Mast cells also have the unusual ability to be triggered by certain molecules and then either activate them or degrade them. Mast cells are scattered throughout gingival CT, often in close association with endothelial cells, but are found sub and intra-epithelially.[6]

Role of mast cells in pathogenesis of Periapical Cyst:

Mast cells may contribute to cyst enlargement in four ways

1) By direct release of heparin into the luminal fluid,

2) By release of hydrolytic enzymes which could degrade capsular extracellular matrix components, thereby facilitating their passage into the fluid, and

3) By the action of histamine on vascular permeability, thus leading the transudation of serum proteins.

4) By stimulating the production of prostaglandins, interleukin-1á, TIMP and other collagenases, which are said to be important in bone resorption and thus, cyst growth.[6,7]

In the present study, we found increased number of mast cells in periapical granuloma as well as periapical cyst when compared with control. Mast cells are found to be more numerous in the periapical cysts than periapical granulomas. When comparison done between the periapical cyst and periapical granuloma, 20% of the results were non-significant, still there was no decrease in the number of mast cells in the radicular cysts when compared to periapical granuloma.

The results of study conducted by Rodini et al (2004) are similar to present study. During their analysis they found that Mast cells tended to be more common in the peripheral regions of both periapical granuloma and radicular cyst. But in the present study such particular distribution was not found .Mast cells tended to be more common in the areas of inflammation.[8] Similar studies were conducted by Shylaja et al (2010), Debta et al. (2010), Ruchi sharma & Sushmita saxena (2010) as well as Madhusudhan et al. (2014). They found highest number of mast cells in the radicular cysts with greatest concentration in the subepithelial zone. This finding is similar to our present study. [9,10,11,12]

In the present study mast cells are found in inflammatory regions as well as fibrotic regions also. Degranulated mast cells are found to be numerous in the chronic inflammatory region in the present study. Several authors claimed that their results showed that Mast cells were mainly located in inflammatory areas; others reported they were chiefly situated in a perivascular position. In the present study we did not find any significant difference in the distribution of mast cells in superficial and deeper regions of fibrous capsule of the radicular cysts.

The results of the study conducted by **Setareh Shojaei et al (2015)** showed presence of higher number of mast cells in periapical granulomas as compared to periapical cysts with no statistically significant difference .This result is contradictory to the results of present study where we found increase number of mast cells in all the radicular cysts cases when compared with periapical granuloma .Although the 20% of the results were non-significant , still there was no decrease in the number of mast cells in the radicular cysts when compared to periapical granuloma.[13]

Mast cells in periodontal disease: In the study by Steinvoll et al (2004) increased numbers of mast cells were found in gingivitis as well as periodontitis. Their findings were similar to our present study.[14] The study carried out by Batista AC, Rodini CO, Lara VS et al (2005) stated that Mast cell densities (cells per mm^2) were significantly increased in chronic periodontitis/gingivitis lesions compared with clinically healthy gingival tissues which are found similar to our present study.[15] A study conducted by Vahabi et al (2011), Lagdive et al in 2013 also showed results similar to present study that increased number of mast cells found in chronic periodontitis sites compared to other sites.[16, 17]

RA popovaci et al (2014) found a significant increase of mast cell density in cases with mild and moderate inflammatory changes, which is similar to the present study. But this study states that there is a slight decrease in patients with severe periodontal disease and Mast cell density and activation increases with moderate inflammation but decreases in severe inflammatory lesions. This finding is in contradiction to present study .Present study shows consistent increase in the number of mast cells from mild to severe inflammation. Intraepithelial Mast cells were found in cases with periodontal disease only and were correlated with the severity of the inflammatory lesion. This finding is in accordance with the present study .Present study also shows increased number of intraepithelial mast cells in moderate to dense and dense inflammation.[18]

Their study concludes that Mast cells are important cellular components of the early stages of periodontal disease but not in advanced-stage periodontal disease. But present study shows increased no. of mast cells in severe inflammatory lesions also. And mast cells are important cellular components in early as well as advanced stage periodontal disease.

CONCLUSION

In the present study, we found increased number of mast cells in the periapical as well as periodontal lesions. Presence of increased number of mast cells in these lesions suggests an active role of mast cells in the pathogenesis of these lesions. The mast cells participate in both acute and persistent inflammatory reactions through the release of various mediators. It may be possible to develop novel approaches that influence the release of pro-inflammatory molecules to effectively reduce mast cell driven inflammation and hence progression of disease. It is important to reassess periodontal disease treatment which is followed by the use of mast cell stabilizing agents as an adjuvant therapy for gingival pathology.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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