

The Significance of Mast Cells and Eosinophils Counts in Surgically Resected Appendix

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Abstract

Objectives: The mast cell remains an enigmatic cell, found resident in tissues throughout the body particularly in association with structures such as blood vessels and nerves. Various inflammatory disorders of the intestines, joints and lungs appear to be associated with an increase in mast cell numbers. The study was conducted on vermiform appendix. The present study was undertaken (1) to compare the mast cell and eosinophil counts in various layers of the appendix in various histopathological groups, and (2) to establish the relationship between the numbers of eosinophils and mast cells in the inflamed appendix.

Materials and Methods: The material for study consisted of appendix specimens received for histopathological examination in the Department of pathology. A 5 year study was conducted, 3 years retrospective and 2 years prospective.

Results: Out of 777 cases studied the incidence of appendicitis is high, in the first and second decades of life and slightly higher in females. Recurrent appendicitis was more common when compared to other inflamed appendices.

Conclusions: Eosinophil counts in all the layers were very high in acute eosinophilic appendicitis compared to normal appendices. A higher mast cell count was seen in acute eosinophilic appendicitis and recurrent appendicitis. No correlation was found between mast cell and eosinophilic density. Our observations support the allergic theory of appendicitis rather than the obstructive theory.

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INTRODUCTION

Mast cell remains an enigmatic, fascinating and cell of diverse functions more than 100 years after its discovery by Paul Ehrlich at the turn of the 18th century. It is a cell that is found widely distributed in the body particularly associated with connective tissues [1]. The mast cells with a battery of crucial chemical mediators and substances in their typical metachromatic granules are known to play a role in health and various disease states in man [2].

Mast cells are being found in varying numbers in practically all tissues, primarily in respiratory, digestive, urogenital systems and skin [2] and are abundant near blood vessels and nerves and in sub epithelial tissues, which explains why local immediate

hypersensitivity reactions often occur at these sites. Mast cells are constantly present in appendix, the organ most commonly subjected to surgical intervention and removal [3]. They arise from hemopoietic tissue in the bone marrow, the progenitors differentiate from primitive cells under the influence of cytokines (IL-3), migrate to other body sites, then undergo differentiation and maturation [1]. They settle in connective tissue and usually do not circulate in the blood period to their environment [1].

Mast cells are similar to Basophils in many respects, including the presence of cell surface IgE Fc receptors as well as cytoplasmic granules. Mast cells have cytoplasmic membrane-bound granules that contain a variety of biologically active mediators they are

activated by the cross-linking of high-affinity IgE Fc receptors. Mast cells may also be triggered by several other stimuli, such as complement components C5a and C3a [3]. Pathogenesis of acute appendicitis is poorly understood. Currently, luminal obstruction due to faecoliths or less commonly submucosal lymphoid hyperplasia especially in children appears to initiate acute inflammation in appendix [4].

Acute eosinophilic appendicitis is characterized by acute presentation and a grossly inflamed appendix, but with absence of neutrophils in the muscle layer. The histological hallmark of the entity is eosinophil infiltration of the muscularis propria with accompanying edema separating muscle fibers [5].

The present study aims at finding mast cell variation in inflamed appendix compared to uninflamed appendix and also to suggest the possible role of mast cells in the pathogenesis and outcome of acute appendicitis.

MATERIALS AND METHODS

The material for study consisted of appendix specimens received for histopathological examination in the Department of Pathology from Al-Ameen medical college, Bijapur. The appendices were removed as a therapeutic measure for the clinically suspected cases of appendicitis or during the course of laparotomy for other diseases. A 5 year study was conducted 3years retrospective from May 2007 to May 2010 and 2 years prospective from June 2010 to June 2012. Appendices were received in 10% formalin. Minimum of 24 hours was allowed for proper tissue fixation. After fixation one section was taken from tip, base and intermediate length and sent for routine paraffin processing. After the processing and embedding of tissue sections into paraffin blocks, 2 sections of 5 micron thickness were cut from each block. One of the sections was stained by haematoxylin & eosin for various findings of

appendicitis and the other by 1% toluidine blue for the identification of mast cells. The number of mast cells and eosinophils in the mucosa, submucosa and muscular layer was counted under high power of the microscope. The average count obtained in 10 non-overlapping high power high fields was considered. The degree of eosinophilic infiltration and mast cell density was evaluated using Pearson's correlation test. The eosinophil and mast cell count in various histopathological groups were compared using ANOVA (DUNNETT) Test.

RESULTS

Out of 777 cases studied 392 were females and 385 were males. The age of the patient in the present study ranged from 6-75 years.

Maximum number of cases was seen between the age group of first and second decades of life, followed by age group of second and third decades. Increased incidence of acute appendicitis was seen in younger age group and recurrent appendicitis in the age group >20 years. Maximum number of cases was recurrent appendicitis, followed by acute appendicitis. 23 cases of acute eosinophilic and 18 cases of acute suppurative appendicitis were seen. It was found that acute appendicitis was more common in females and incidence of recurrent appendicitis is slightly higher in males, compared to females.

Highest mean eosinophil count was seen in acute eosinophilic appendicitis and was statistically significant ($p < 0.001$), followed by recurrent appendicitis (Table 1). Highest mean mast cell count was seen in acute eosinophilic appendicitis and was statistically followed by recurrent appendicitis (Table 2). Only two cases of appendicitis with parasitic infestation were noted in the study.

Table 1: The comparison of eosinophil counts in the various layers of appendices in various histopathological groups

Histopathological groups	No of cases	Total mean eosinophil count/sq mm		
		Mucosa	Submucosa	Muscularis Propria
Normal	40	28.4±12.5	26.2 ±11.5	21.2±10.3
Acute appendicitis	340	23.7±10.7	24.5 ±11.3	22.4 ±9.7
Acute suppurative appendicitis	18	25.94±11.8	26.1 ±10.3	18.5 ±6.6
Acute eosinophilic appendicitis	23	69±30.2	48 ±29.1	44.6 ±23.9
Recurrent appendicitis	356	34.2±18.6	30 ±18.2	28.2± 16.8
Total	777			

Table 2: The comparison of mast cell counts in the various layers of appendices in various histopathological groups

Histopathological groups	No of cases	Total mean mast cell count/sq mm		
		Mucosa	Submucosa	Muscularis Propria
Normal	40	7.2±3.7	8.15± 4.7	9.38± 4.9
Acute appendicitis	340	8.8±4.2	8.48 ±4.48	8.16 ±3.8
Acute suppurative appendicitis	18	8.3±3.4	8.27± 5.26	9.05± 5
Acute eosinophilic appendicitis	23	19.5±11.5	16.6 12.8	16.3 ±9.3
Recurrent appendicitis	356	11.3±6.1	10.2 5.8	9.99 ±5.6
Total	777			

DISCUSSION

The worm-like structure, the vermiform appendix is an appendage to the caecum with no obvious function in the Homo sapiens. It is now recognized that it is a specialized structure, probably concerned with the establishment and maintenance of the body defense and immunity of the body.

In the current study, recurrent appendicitis was seen more frequently than acute appendicitis but in many studies acute appendicitis is far more common [6]. Maximum number of cases was seen between the age group of first and second decades of life, with incidence falling after third decade. Peak incidence of appendectomies was observed in teens and early 20's. The incidence of recurrent appendicitis was higher in the age group above 20 years.

In the present study, normal appendices showed low eosinophil count compared to acute eosinophilic appendicitis, which showed increase in eosinophil count in all the layers of appendix and was statistically significant.

Highest incidence of appendectomy was seen in females (50.4%) in our study similar to the observation seen by Lee [7]. The highest number of negative appendectomies was seen in females, similar to the study done by Althoubaity [8].

Studies have found a significant increase in eosinophils in acute appendicitis compared to normal appendices and have stated that increase in eosinophils and mast cells may be cause of the pain in histologically normal but clinically suspected acute appendicitis [9].

In the present study, the most significant increase in mucosal mast cell count was seen in acute eosinophilic appendicitis, followed by recurrent appendicitis. Intermediate counts were seen in mucosa of acute appendicitis and acute suppurative appendicitis and very low mast cell count was seen in normal appendix.

Studies have found that the Mast cell counts were lowest in normal appendices, significantly higher in acute appendicitis and highest in chronic appendicitis. Hence a type I hypersensitivity reaction with release of mediators by mast cells might be another triggering factor for the sequence of events leading to appendicitis [10].

In the present study no correlation was found between mast cell and eosinophilic density. Our observations support the allergic theory of appendicitis rather than the obstructive theory. There was no correlation of mast cell count and sex.

In the present study 36% showed fibrosis in submucosa and 56% in muscularis propria and highest number of cases of fibrosis was seen in recurrent appendicitis

compared to other histopathological groups. High mast cell count was seen in recurrent appendicitis with fibrosis in all layers as compared to other inflammatory appendices. Thus mast cells are considered as key effector cells in tissue repair and remodeling [11].

As a result, recurrent appendicitis when compared to other inflamed appendices was found to be more common. The incidence of appendicitis is high, in the first and second decades of life and slightly higher in females. The highest number of negative appendectomies was seen in females. Eosinophil counts in all the layers were very high in acute eosinophilic appendicitis compared to normal appendices. A higher mast cell count was seen in acute appendicitis and recurrent appendicitis. Mean mast cell counts were high in recurrent appendicitis with fibrosis, when compared with no fibrosis. Obstruction due to faecolith could not be demonstrated in many cases of appendicitis. Hence we conclude that mast cell activation may be one of the important factors in causation of appendicitis and supports allergic theory of appendicitis rather than obstructive theory.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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