

## THE HISTOCHEMICAL STUDIES OF THE SUBMUCOSAL GLANDS IN CHRONIC MAXILLARY SINUSITIS

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During past decade, histochemical observation of the sinusal mucosa involved in chronic inflammatory process have been frequently reported. However, there are relatively few reports which are concerned with the histochemical changes of the affected submucosal glands, which are considered to be one of the important sources of the hyperrhinorrhoea in chronic suppurative sinusal disease.

In this presentation, the histological observation of the developmental process of the submucosal glands in the maxillary sinusal mucosa involved in chronic inflammation will be reported, and then, the histochemical changes observed in the submucosal glands in the various secreting stages will be demonstrated.

### Material and method

About three hundred pieces of the sinusal mucosa removed surgically from two hundred patients with uni- or bilateral maxillary sinusitis were used as the material. These specimens were fixed in 10 % formalin or Carnoy's solution for at least 24 hours, then blocked and after the usual processing of tissues with dehydration, clearing and paraffin embedding, the tissues were cut in four to six micron sections. The sectioned tissues were attached to slides by egg albumin and stained with hematoxylin-eosin. PAS reaction, and with Alcian blue stain.

### Observations

#### 1. The developmental process of the submucosal glands:

In the mucosa of the maxillary sinuses with no pathologic changes, glands are found in small numbers. However, when inflammatory processes occur therein, submucosal glands appear and then increase in number. At first, on the surface of the epithelial layer of the sinusal mucosa, slight subsidences occur, probably due to inflammatory irritation. These subsidences have many goblet cells at their bottoms. They gradually deepen into the submucosal tissue, and finally, when deep, branch off to make many glandular acini. Thus, the submucosal glandular lobules are completed. The completed glandular lobules consist of varying numbers of the tubulo-acinar glands with some surrounding lymphoid cells. In some instances, due to inflammatory processes, the sinusal mucosa greatly increases in thickness and becomes more or less fibrotic. In this chronic inflammatory mucosa the submucosal glands persist without

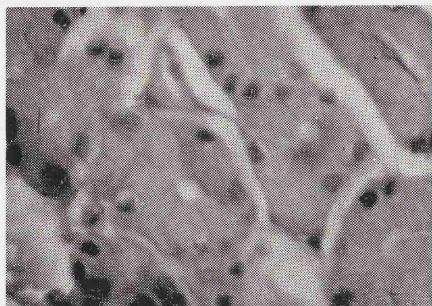


Figure 1. Mucus secreting cells.  
PAS reaction x 600.



Figure 2. Serous secreting cells.  
Alcian blue stain x 600.

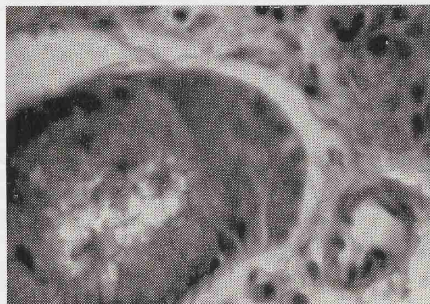


Figure 3.  
Demilunes Alcian blue stain x 600.



Figure 4.  
Demilunes PAS reaction x 600.

any evidence of atrophic change. Therefore, in the mucosa involved in chronic suppuration, fibrotic areas associated with many glandular lobules are frequently observed and this characteristic histological appearance is classified as the fibroglandular type.

## 2. Histochemical observation of submucosal glands.

In the maxillary sinus mucosa involved in a chronic inflammatory process, the majority of the submucosal glands consist of mucus secreting cells; only a few of them consist predominantly of pure serous secreting cells. The mildly or moderately mucus secreting cells are characterized by coarsely granular cytoplasm with basally located, darkly stained, and relatively small nuclei. (Fig. 1).

The cytoplasm of the mucus secreting cells contains granules stained by Alcian blue and PAS positive granules. The former indicates the presence of acid mucopolysaccharides only and the latter indicates that of both neutral and acid mucopolysaccharides.

The serous secreting cells on the other hand, are characterized by finely granular and clear cytoplasm with fairly large nuclei (fig. 2) and can be easily identified morphologically from the mucus secreting cells.

It is well known that the terminal cells of some glandular acini are occasionally compressed by the distended mucus secreting cells and present as crescent-shaped elements termed demilunes, which are usually considered to be serous secreting cells (fig. 3). However it is impossible to make clear the histoche-

mical differences between the mucus secreting cells and so-called serous secreting cells (demilunes) in these acini, because the cytoplasm of the cells forming the demilunes are stained a faint turquoise blue by Alcian blue and a faint rose red by PAS reaction (fig. 4).

In the mucus secreting acini, some of the cells appear to be actively secreting an abundance of mucus, which distends the acinar lumen, sometimes, with cystic dilatation of the ducts.

In the lumen of acini consisting of mucus secreting cells, masses of the material stained very faint rose red are frequently found mixing with masses of mucus stained turquoise blue by Alcian blue. But these masses could not be positively defined at this observation.

Double application of Alcian blue staining and PAS reaction revealed that basal cytoplasm of the mucus secreting cells has predominantly an affinity with PAS positive reaction, whereas, the apical cytoplasm of these cells has an affinity toward both PAS positive reaction and Alcian blue staining. In other words, there are more acid mucopolysaccharides in the apical cytoplasm of the mucus secreting cells than in that of the basal.

There are many goblet cells scattered throughout the surface of the sinusal mucosa and of the glandular ducts which produce mucus secretion and are clearly stained by Alcian blue and by PAS reaction.

Besides the mucus secreting glands and goblet cells, there are large cytes in the submucosal tissue, which are stained bright blue by Alcian blue and bright rose red by PAS reaction. So, this large monocyte can be considered a mucus containing cell.

The goblet cells are found abundantly even on the surface of sinusal mucosa with no pathologic changes, but the large mucus secreting monocytes are not so frequently found in the mucosa removed from the maxillary sinuses.

## Conclusion

From above mentioned observations the following conclusions can be drawn:

1. The submucosal glands in the maxillary sinusal mucosa increase in number due to chronic inflammatory processes.
2. The majority of the submucosal glands in the maxillary sinusal mucosa consist of mucus secreting cells, but a few of them consist of serous secreting cells.
3. The mucus secreting cells are stained turquoise blue by Alcian blue, and bright rose red by PAS reaction, whereas, the serous secreting cells are scarcely stained by either.
4. The cells consisting of so-called demilunes, which are considered serous secreting cells, are stained faintly by Alcian blue as well as by PAS reaction. Therefore, the demilunes are not considered to be composed of, exclusively at least, pure serous secreting cells.
5. Double application of Alcian blue staining and PAS reaction revealed that there are more mucopolysaccharides in the apical cytoplasm of the mucus secreting cells than in the basal.

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