

Antileukoprotease in patients with maxillary sinusitis

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SUMMARY

Antileukoprotease, an inhibitor of leukocyte elastase, was studied in paired sera from 12 patients with maxillary sinusitis. The serum concentration of antileukoprotease was increased at the day of admission to hospital, compared with the serum concentration in convalescence sera. In purulent maxillary sinus secretions antileukoprotease was found in complex with leukocyte elastase, as shown by gel filtration. The findings suggest a local protective function of antileukoprotease in maxillary sinus.

INTRODUCTION

Leukocytes contain proteolytic enzymes, which are released extra cellularly from the granulae during phagocytosis of e.g. micro-organisms. An inflammatory disease with a high concentration of leukocytes thus results in a local increase of proteolytic enzymes. A free proteolytic enzyme activity would be injurious to the mucosal membranes of the respiratory tract and the enzymes must therefore be neutralized. For this purpose there is a defence mechanism composed of inhibitors, which inactivates the proteases by blocking their active sites.

The leukocyte proteases are elastase, neutral protease and cathepsin G. Leukocyte elastase is important, due to its association with degenerative connective tissue diseases. It is a broad reacting enzyme and among its substrates is elastin. Leukocyte elastase is supposed to be an important factor in the development of pulmonary emphysema.

The dominating inhibitors of leukocyte protease, α_1 -antitrypsin, α_2 -macroglobulin and antichymotrypsin, are responsible for more than 90% of the inhibitory capacity in plasma. In addition there is a low molecular weight acid stable inhibitor, called antileukoprotease. Antileukoprotease is a potent inhibitor of leukocyte elastase and cathepsin G. It is a secretory protein and has been demonstrated in the serous glands and goblet cells in the respiratory tract mucosa (Fryksmark et al., 1982).

With a radioimmunoassay it has been found in trace amounts in human serum (Fryksmark et al., 1981). The normal serum level in healthy persons was 125 ± 20 $\mu\text{g/l}$ (Fryksmark et al., 1981). In patients with pneumonia, the serum level of antileukoprotease increased significantly above the normal level (Fryksmark et al., 1984). In purulent bronchial secretions antileukoprotease exists in an active form, bound to leukocyte elastase, and depending on the amount of antileukoprotease present, there is more or less free elastase activity (Fryksmark et al., 1984).

The purpose with this investigation was to see if an infection in the maxillary sinus is reflected in the serum level of antileukoprotease and to study the ability of antileukoprotease in maxillary sinus secretion to form complexes with leukocyte elastase and thus prevent the destructive elastase activity.

MATERIAL AND METHODS

Twelve patients with clinical symptoms of maxillary sinusitis, i.e. purulent nasal secretions and face-ache, were studied. The diagnosis was verified by ultrasonography and/or X-ray of the maxillary sinus.

Sera were drawn at the day of admission to hospital and convalescence sera were drawn at the earliest two weeks later. Maxillary sinus secretions were aspirated at the day of admission. The samples were centrifuged and the supernatants were stored at -20°C until examination.

All samples were analysed for antileukoprotease. In addition the maxillary sinus secretions were analysed for free elastase activity and then subjected to gel filtration on a Sephadex G-75 column, to further study the relationship between antileukoprotease and leukocyte elastase.

The difference between the groups of serum samples were tested using the Wilcoxon Signed-Rank Test for paired differences.

RESULTS

Sera from the 12 patients with maxillary sinusitis showed elevated levels of antileukoprotease at the day of admission to hospital. The mean value was 153 ± 54 $\mu\text{g/l}$. Convalescence sera were within normal level with a mean value of 122 ± 20 $\mu\text{g/l}$. The difference is significant ($p < 0.01$) (Figure 1).

The maxillary sinus secretions all contained antileukoprotease in a concentration above normal serum level. Three of 12 secretions revealed free elastase activity (Figure 2). The gel filtration analysis of these samples showed no free antileukoprotease. The remaining nine maxillary sinus secretions displayed the presence of an excess of free antileukoprotease and no free elastase activity (Figure 3).

DISCUSSION

Antileukoprotease is normally present in human serum as a trace protein (Fryks-

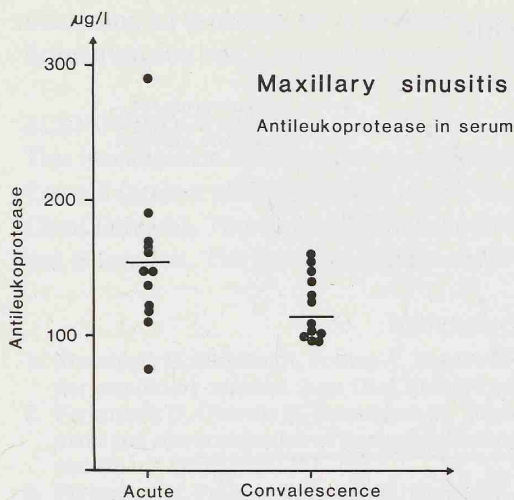


Figure 1. Distribution of antileukoprotease in sera from patients with maxillary sinusitis.

mark et al., 1981), conceivably a spill-over from the respiratory tract. An acute inflammatory disease in the respiratory tract, i.e. pneumonia, causes an increase of antileukoprotease, which is reflected in the serum (Fryksmark et al., 1984). The serum concentration of antileukoprotease is also increased in patients with maxillary sinusitis, though not to the same extent as in patients with pneumonia. This may be an effect of the larger area of the respiratory tract engaged in patients

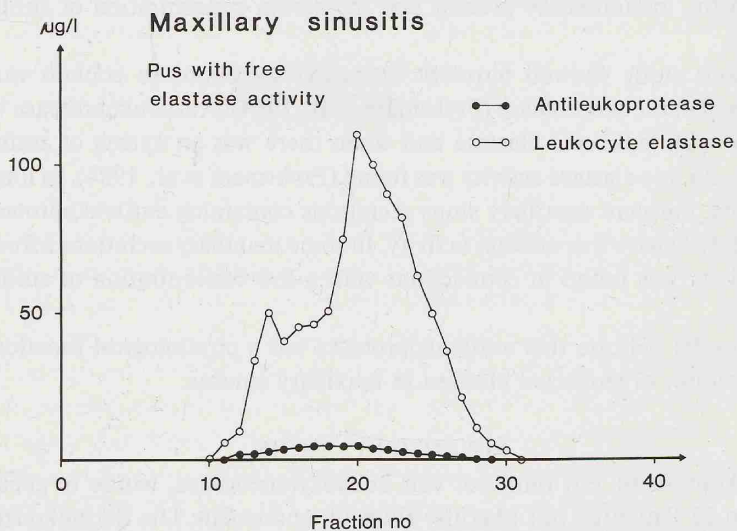


Figure 2. Partition of antileukoprotease and leukocyte elastase in the fractions obtained by gel filtration on a Sephadex G-75 column of purulent secretions from a patient with maxillary sinusitis. The secretion contained free elastase activity.

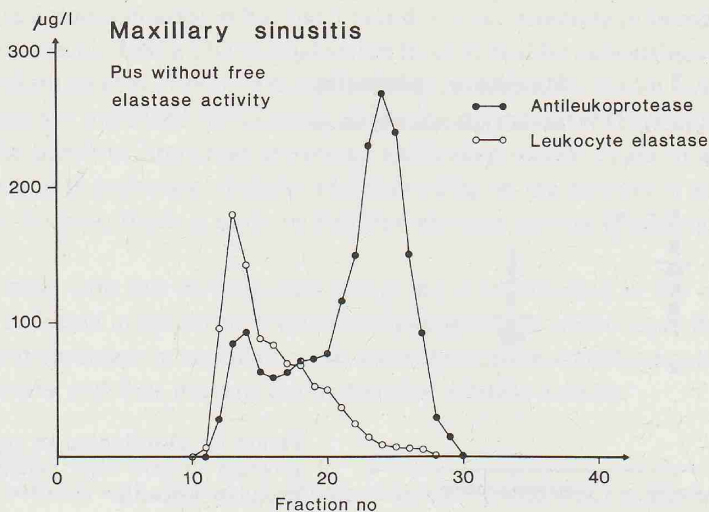


Figure 3. Partition of antileukoprotease and leukocyte elastase in the fractions obtained by gel filtration on a Sephadex G-75 column of purulent secretions from a patient with maxillary sinusitis. The secretion contained no free elastase activity.

with pneumonia. In both groups of patients the serum level of antileukoprotease is within normal level in the convalescence sera, suggesting a close correlation between the inflammatory process and the serum concentration of antileukoprotease.

A previous study showed purulent bronchial secretions to contain variable amounts of antileukoprotease (Fryksmark et al., 1984). Antileukoprotease was in complex with leukocyte elastase and when there was an excess of antileukoprotease, no free elastase activity was found (Fryksmark et al., 1984). In line with these data, purulent maxillary sinus secretions containing antileukoprotease in excess did not have free elastase activity. In some maxillary secretions a free elastase activity was found in connections with a low concentration of antileukoprotease.

These results indicate that antileukoprotease has a physiological function as a local inhibitor of leukocyte elastase in maxillary sinuses.

ZUSAMMENFASSUNG

Antileukoprotease, ein Inhibitor von Leukozytenelastase, wurde in gepaarten Sera von 12 Patienten mit Maxillar-sinusitis untersucht. Die Serumkonzentration von Antileukoprotease war am ersten Tag erhöht im Vergleich zu der Serumkonzentration in Rekonvalescentsera. In eitrigem Sinus maxillarissekreten wurde Antileukoprotease in Komplex mit Leukozytenelastase gefunden, wie bei Frak-

tionierung an Sephadex G-75 bewiesen war. Die Funde deuten auf eine lokale Schutzfunktion von Antileukoprotease in Sinus maxillaris hin.

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