

SOME REMARKS OF SCANNING AND TRANSMISSIONAL ELECTROMICROSCOPIC INVESTIGATIONS OF CHRONIC INFLAMMATED MUCOSA AND POLYPS OF NOSE AND PARANASAL CAVITIES

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The electromicroscopic scanning of the changes on the surface and morphological structures of the chronic inflamed mucosa and polyps of paranasal cavities was performed. With the help of the transmissional electromicroscopia there were also observed some changes of the lamina epithelialis of mucosa of paranasal cavities and polyps. As the result, some electromicroscopic changes of the ciliar apparatus of chronic inflamed mucosa and polyps of paranasal cavities were noticed and, as well as the changes of the quality of outer morphology of the epithelialis were verified with the help of the scanning electromicroscopia. The clinical research included the 20 patient samples. So, the conclusion was the presence of the denudation and reduction of the cell rows and the goblet cell metaplasia, which reduce the barrier function of mucosa. *Acta Medica Medianae 2004; 43 (3): 11-16.*

Key words: chronic inflamed mucosa, polyps of nose and paranasal cavities, scanning and transmissional electroscopic study

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Introduction

Adequate functioning of the cilia of the respiratory epithelialis is necessary for the mucosal transport to be in complete preserved. It is of great importance for the first line defence of mucosa and paranasal cavities from particles, bacteria, viruses and the other substances inhaled into an organism with air. The inadequate transport of enumerated substances enables their constant persisting in the mucosa with the disturbance of its immunity, as well as the foundations for the appearance of chronic infections. We illuminated in this study what are the ultra structural defects that make it possible for the disturbance to appear, known as the syndrome of the immovable cells.

Subject and aim of the research

The subject of this research represents the scanning and electromicroscopic observing of the changes on the surface and morphological structures of the chronic inflamed mucosa and polyps of the paranasal cavities, as well as their ultra structural

changes (number of the goblet cells, their activity and their ciliar structure, etc.).

So, the set task was to:

1. Follow the changes of the lamina epithelialis of mucosa of the paranasal cavities and polyps with the help of the transmissional electromicroscopia.
2. Observe the electromicroscopic changes on the ciliar apparatus of the chronic inflamed mucosa and polyps of the paranasal cavities.
3. Verify the changes of the quality of the outer morphology of the epithelialis with the help of the scanning electromicroscopia.

Materials and methods

Clinical material used for the research comes from about 20 hospitalized patients from the Clinic for otorhinolaryngology, Clinical Center, Nis. All the patients underwent the trepanation of the maxillary sinus procedure according to Caldwell-Lucc; operations were done with the endotracheal anesthesia with the usual surgery techniques.

Pieces of mucosa were firstly fixed in 2,5 % of glutaraldehyde for the transmissional electromicroscopia by which researched the ultra structure of cells and their organelle, and then we performed the prostification in 1% osmine-tetraoxid. The dehydration was done through the input row alcohol (30%, 50%, 70%, 95%, 100%). After the treatment with the propylene-oxide, the preparation was patterned in the epon. With the ultramicrotome there was performed the

trimming and cutting of half-thin patterns of 1 micron and ultra thin patterns of 400 angstroms of thickness. This cut patterns were painted with the uranium-acetone and P6-citratone. The JOEL electromicroscope with the enlargement of 2000±130000 times did the observation and scanning.

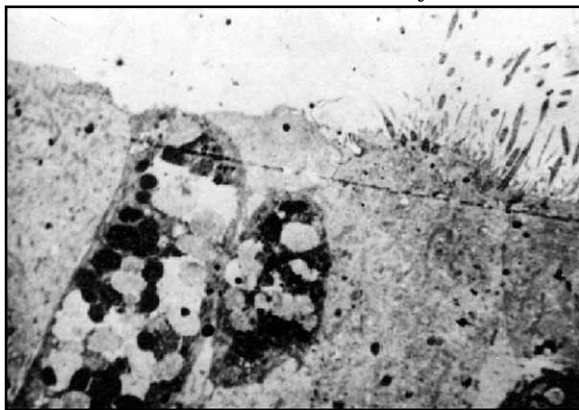
The scanning with the electromicroscopia led us researching the cell shapes and surfaces of the tissues. Firstly, we fixed one part of the mucosa in 2,5% of glutaral-aldehyd and then we post-fixed it in 1% of osmine-tetraoxide. The dehydration was done with the input rows of alcohol, and then the patterns we transferred by the input rows of acetone (30%, 70%, 90%, 100%). The drying process was done in the „critical point”. The spattering steamer with the ions of gold performed the process of the steaming. The JOEL electro microscope with the enlargement of 400±90000 times did the research and scanning.

Research results

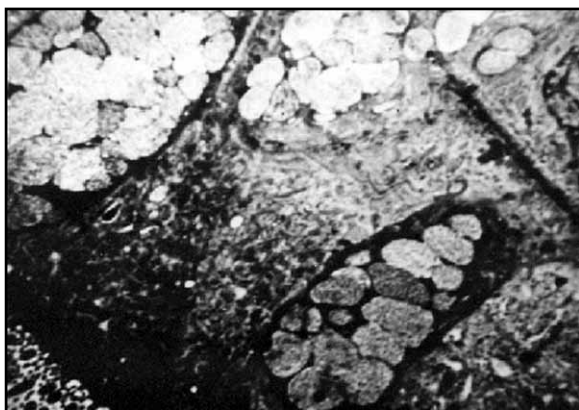
The observed electromicroscopic changes, appearing in the lamina epithealis of the chronic inflammed mucosa and polyps of the paranasal cavities, are very interesting and evident and also characterized by:

‡ Abnormally increased number of the goblet cells comparing to the cylindrical cells, which is disproportional with the normal mucosa.

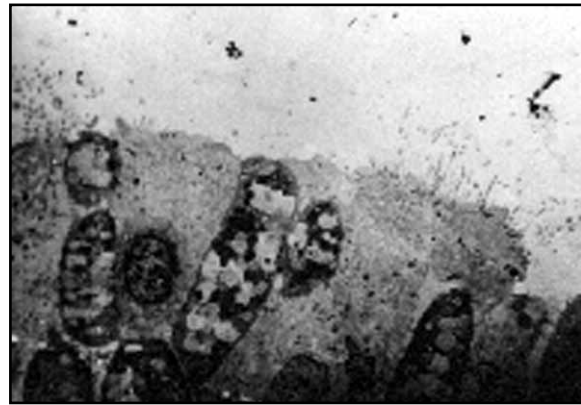
‡ The reduction of number, size, length and distribution of the cilia is on the cylindrical cells



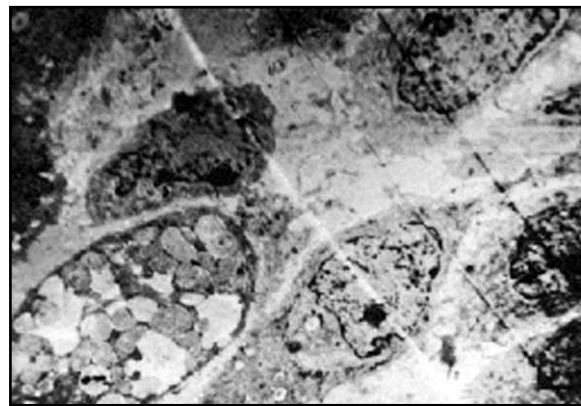
Picture 1



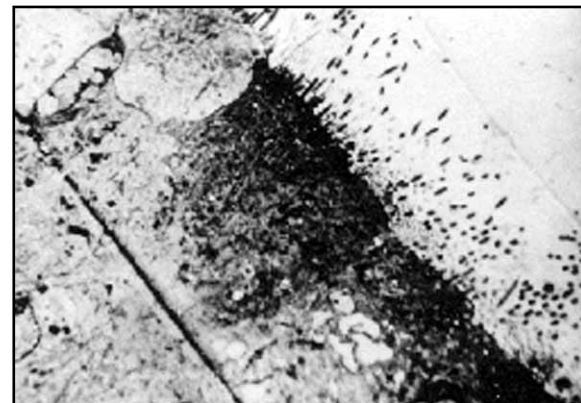
Picture 2



Picture 3



Picture 4. There are the goblet cells in different phases of their development to the mature cylindrical cells. It is possible that the cell from the left hand side is in the necrobiosis. TEM, x 6000



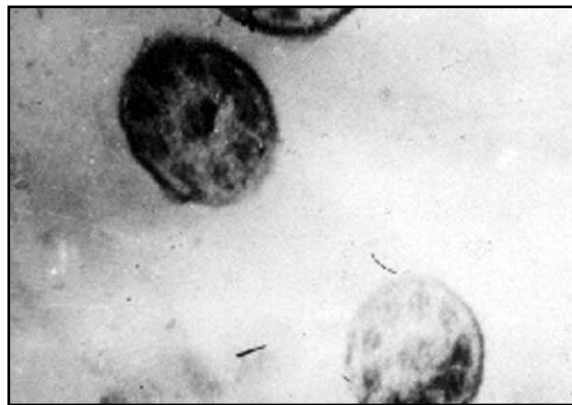
Picture 5. A larger number of the vesicles can be observed in the apical part of the ciliar cylindrical cells. The impossibility to recognize and the edematization of the citoplasmatic structures with of the ciliar cell are observed in the apical part. TEM, x 6000

(Picture 1). It is interesting that the goblet cells can also be researched in the deeper parts of lamina epithelialis (Picture 2) in whose segments of the cells which are nearer to the surface multiphase of the secretorial activity can be observed and researched.

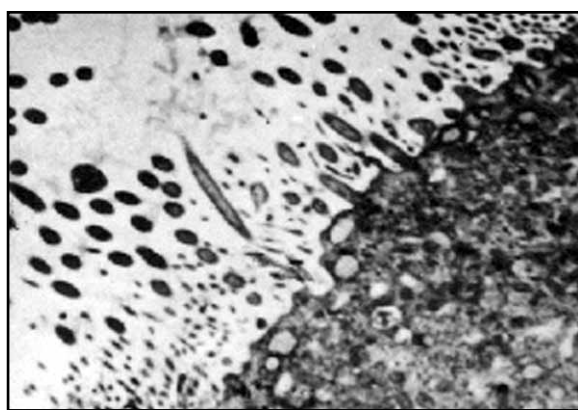
This activity is seen in an unequal thickness of the center of the secretorial granule and the quantity of the secretorial material. Not only was the number of the goblet cells increased, but also their secretorial



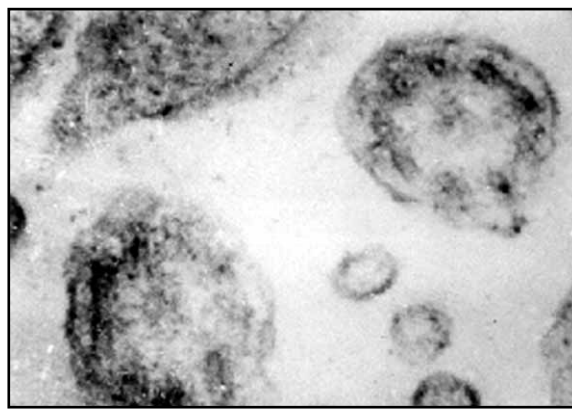
Picture 6. The peak parts of the two cylindrical cells with relatively reduced cilia of unequal size; the presence of zonal occludens. TEM, x 6000



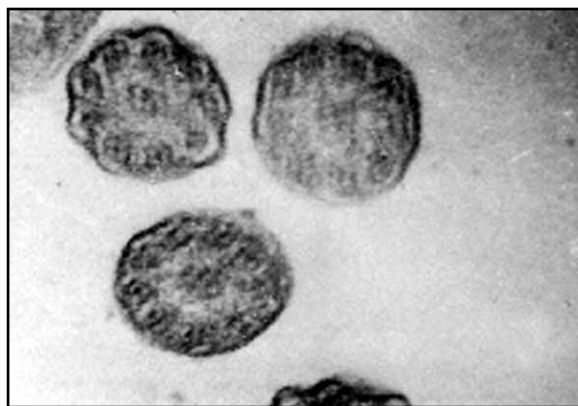
Picture 9. The central pair of the deplete is unclear, missing out the envelope and the radial connections with the peripheral deplete. TEM, x 66000



Picture 7. The apical part of the cylindrical cell with the great number of the vesicular formations has the caveolar appearance. TEM, x 4000



Picture 10. The easy change of the position of the peripheral pairs and the absence of the inner and outer pairs of the handles. TEM, x 66000



Picture 8

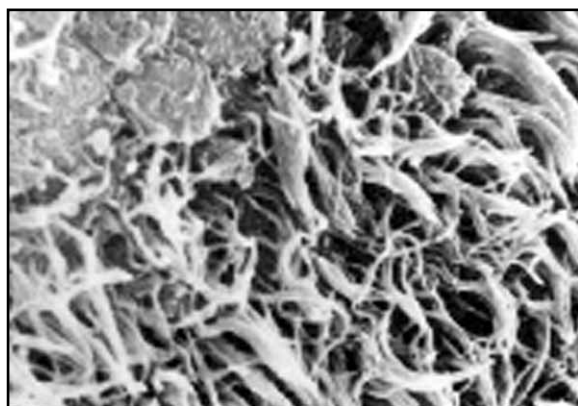
activity. Looking at one electronic microgram, we can see that this kind of the cell releases its secretorial material to the surface as shown in the picture (Picture 3). At the same time we can observe some parts of the cylindrical, so called „the nail cells”, which are next to the goblet cells. The cylindrical cells very often show a greater number of vesicles in the apical and upper parts of the cells. It is possible to observe the presence of the outer complexes among the cylindrical cells especially parts, as zonula occludens.

All the cilia were cut in the height of the deplete, although the intersections, which extended to some peak parts of the cilia when there was not, observed the presence of the depletes.

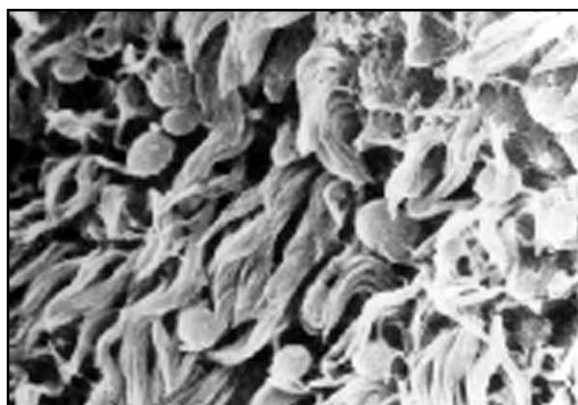
Although there are some technical defects, it is undoubtful that there is the presence of nine peripheral sets and the central pair itself is not understandable. There can also be observed a certain change of the positions of the peripheral depletes, as well as a greater the interdifferentiation.

The absence of the outer and inner pair of handles was sporadically observed, as well as the absence of the interconnectional joints among the neighboring pairs in the deplete. In the largest number of cases, an envelope around the central pair and the nexon connection, which radially extends from the peripheral to the central pair are missing (Picture 8).

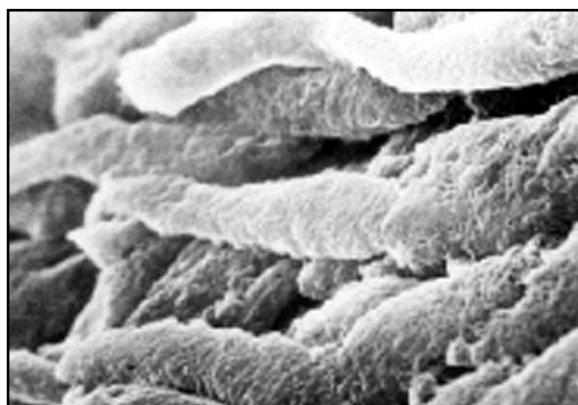
During the electromicroscopic scanning, an irregularity of the surface of the lamina epithelialis of the mucosa and polyps of the paranasal cavities can be noticed. Also, there can be noticed the presence of a greater number of cells and the increase of the field of apical surface of the goblet cells, with the presence of an enormous number of granule on the surface, as well as the quantity of the clots in the mucosa. There can be seen the fields with the goblet cells in the presecreto-



Picture 11



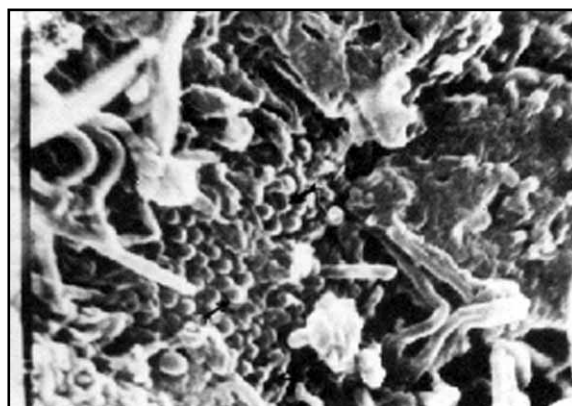
Picture 12



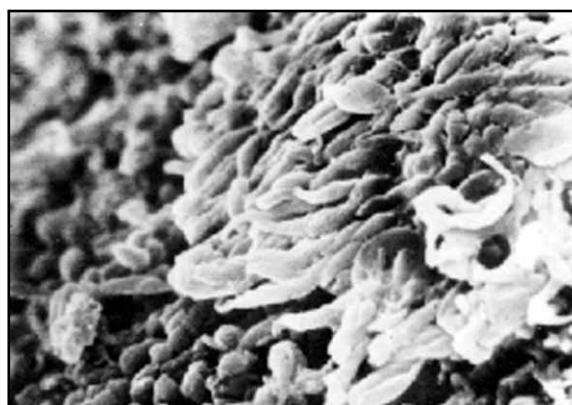
Picture 13

rial phase, which are very thickened and concentrated in one field. The microvils on the surface of the cylindrical cells are more difficult to be noticed, but the interesting thing is that the cilia are not only more observable, but also unequal in number and size (Pictures 11, 12).

The cilia are very often sheaved and apically stuck, what decreases their functional activity (Picture 13). The result is the inequality of the length of the cilia, and with the greater enlargements it can also be seen that the cilia are of a changeable thickness (observed from their length) and of an irregular surface, covered with some of the secretorial granule and mucosal mass.



Picture 14. The central part is occupied by the goblet cells in the presecretorial phase with the grain like convexities of the surface (arrows) as with the lumps of the mucosa on their surface (double arrows), while there are irregularly folded cilia of the neighbouring cylindrical cells. SEM, x 3000



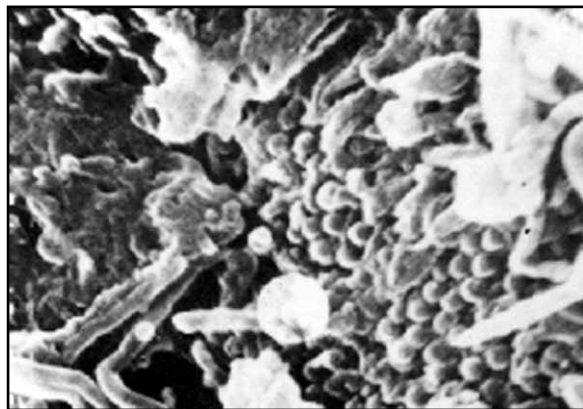
Picture 15. The lumps of the mucosa over the surface of the secretorial granules; the cilia of the irregular size are seen. SEM, x 3000

Discussion

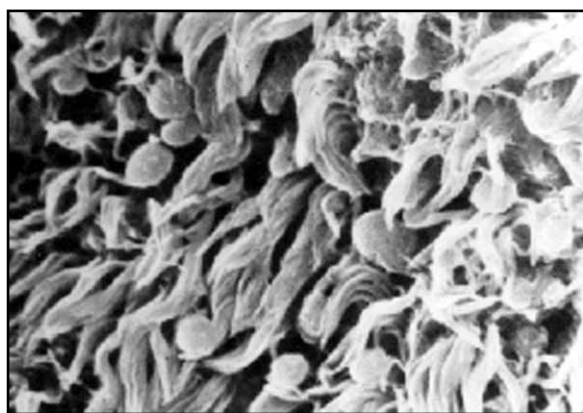
Taking into the account the research results, it can be seen that the chronic inflamed mucosal paranasal cavities are characterized by the increasing of the secrete, disturbance of the secretorial components, changes in their quantity, inner morphology of the cells, as well as the changes of the lamina epithealis characteristics.

Based on the analysis of the transmissional electromicroscopia, there can be noticed a disturbed balance of the lamina epithealis cells of mucosa in advance to the goblet cells, which is viewed in the over increasing of their number. Actually, the number of the goblet cells, proportional to the cylindrical cells, does not have the usual ratio 1:5, but it is reversed and it is 1:4 for the goblet cells that are evidently widened.

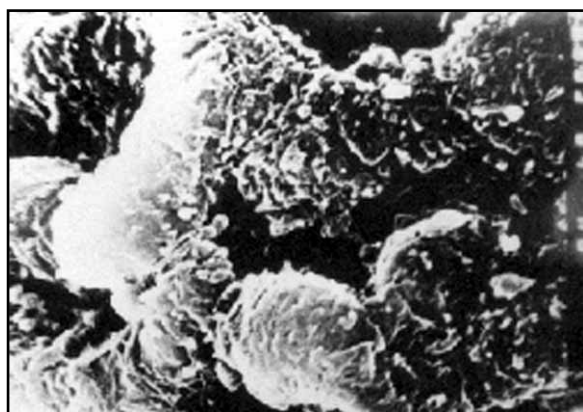
Mucosa does not extend only to the peak, but it extends to the cells up to the basal parts where the secretorial activity is very much expressed. Clinically seen, the larger is the secrete, the more chronic is the process. At the same time, the reduction of the cilia



Picture 16. The field of the goblet cell covered with the convexities of the secretorial granules and with the lumps of the mucosa, and surrounded with the few cila. SEM, x 3000



Picture 17. The sheaved cilia, of the unequal length and width, of the different directions; there are different secretorial drops. SEM, x 4000



Picture 18. The surfaces of the twisted inward cilia are harsh and covered with the mucosal lumps. SEM, x 8000

and microuvula do not drainage adequately mucosal or other contents, pathogenic (bacteria, fungi, etc.), which in the essence denotes the disturbance of the mucociliar transport. The absence of the parts of pair tubules in the cilia, the reduction of number and the irregularity of the shape of the cilia lead to their decreased moveability. The presence of a great number of the vesicular formations, especially apically, in the cylindrical cells is not completely

clear, but it is possible that pinocytroous vesicles are in question, which would lead to the reversed transport of secret to the cells, but not from them. According to our opinion, the formerly described vesicles do not have a sub apical position, but they do have a typical apical position with the beginning of the formation of the caveolas, i.e. structures similar to them. The transmissional electroscopia of the epithel of chronic inflammated paranasal cavities and the polyps is characterised by the goblet like metaplasia increased by the secretorial activity of the same and by the quantity of the mucus which is the same with the researches of other authors al. (1, 2, 3, 4, 5). This leads to the overburdening of the ciliar apparatus of the cylindrical cells, to the partly retention of the mucus, and to the making of the conditions for the development of infections and the decrease of the secrete of the secretorial IgA.

As far as the cilia itself is concerned, the transmissional electromicroscopia showed the changes which had been described other authors researching the Kartagener Syndrome, the nasal and sinusoal inflammation processes, as well as the allergic processes of the same † the absence of the axseolmal handles, the partly absence of dynein handles of the lateral pair and radial extensions in the cilia, which leads to the diskinesia and immovability of the cilia in the cylindrical cells (6, 7, 8, 9). The function of the cilia is influenced by the quality of the seromucosal content, but according to our opinion, the changes seen in the build up of the cilia on the electromicroscopia are both under the outer and inner influences.

All the formerly noticed characteristics can be defined as the phenomenon known „Syndrom of the immotilia cilia“ mostly characterized for the recurrent infections of the respiratory tract (6). In the framework of the other changes, the absence of the even handles, the radial and neighbouring connections characteristic for the syndrome of the immovable cilia can appear even in the phenomenon called the primary ciliar diskinesia. However, our results, especially the existence of the incomplete central microtubules, lead us undoubtedly to the conclusion that it is the question of the mucus infection resulting with the appearance of the immovable cilia syndrome.

On the other hand, when the function of the cilia is decreased, the result is the chronic infection of the respiratory tissue. There are a great number of some subtle defects and some of them are caused by the local influences. A certain influence of the autolitic changes is not denied however. The possibility of the influence of the nasal allergies on the patients is also allowed.

The result of the scanning electromicroscopia leads to the hypersecretorial activity of the goblet cells, whose number and size are increased in respect to the cylindrical cells. The cilia of the cylindrical cells are irregular in order (in sheaves stuck in their peaks), and appearance (short and of unequal width in their length), which makes difficult their motality, weakens the mucus drainage and enables their retention on the places of their origin.

Conclusion

1. There are the denudation and the reduction of the cell rows and the metaplasia of the goblet cells, which decrease the barrier function of mucus at the chronic inflamed mucosa of the paranasal cavities and polyps.

2. This leads to the prevention of the expression of the secretorial IgA, which disturbs the mucosal immunity.

3. The syndrome of the immotile cilia causes the absence of the mucociliary transport.

4. This leads to the impossibility for the bacteria, fungi, viruses and particles inhaled to be adequately and qualitatively removed at the same time making the conditions for the genesis of the recurrent (chronic) infections of mucus of the paranasal cavities.

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NEKA ZAPA@ANJA O SCANNING I TRANSMISIONIM ISTRANJIMA HRONI^NO UPALJENE SLUZOKO@E NOSA I PARANAZALNIH [UPLJINA

Misko Zivic

Prikazane su elektromikroskopske skenirane promjene površine hronično inflamirane mukozne polipa i paranazalnih {upljina kao i promjene morfoloških struktura. Uz pomoć transmisione elektromikroskopije tako je su posmatrane promjene lamine epitelijalne mukozne paranazalnih {upljina i polipa. Kliničko ispitivanje je uključilo 20 uzoraka. Postoji denudacija {elijalnih nizova kao i metaplazija peharastih {elija, sa smanjenjem barijerne funkcije mukozne. *Acta Medica Medianae* 2004; 43 (3): 11-16.

Ključne riječi: hronično upaljena mukozna, polipi nosa i paranazalnih {upljina, skenirana i transmisiona elektromikroskopija