

ТЕОРЕТИЧНА І ЕКСПЕРИМЕНТАЛЬНА МЕДИЦИНА

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*N. Yu. Emelyanova**GI «L.T. Malaya Therapy National Institute of the National Academy of Medical Sciences of Ukraine», Kharkov***CYTOLOGICAL AND MORPHOMETRIC PECULIARITIES OF THE GINGIVAL CELLS IN PATIENTS WITH CORONARY HEART DISEASE**

Periodontal tissues diseases are of a multifactorial nature and depend not only on local etiological causes, but may also be due to somatic pathology. During pathological changes initiation, gingival epithelial cells are able to perform the functions of antigen-presenting cells. Of particular interest is coronary heart disease, which can lead to an imbalance in the process of differentiation of gingival epithelial cells, changes in their morphometric parameters and its quantitative increase in cells with manifestations of cytopathology. Concerning the manifestations of cell pathology and changes in the morphometry parameters of gingival epithelial cells were studied in patients with coronary heart disease. A total of 71 patients with coronary heart disease and 20 somatically healthy patients were examined. Cytological examination was performed on scrapings from the epithelium surface of the attached gingiva. It is proved that in patients with ischemic heart disease, changes in gingival epithelial cells with signs of nuclear pathology and changes in the nuclear-cytoplasmic ratio are statistically more common than in somatically healthy patients.

Keywords: *coronary heart disease, periodontal tissue, cytopathology, morphometry, epithelial cell.*

Introduction

The term periodontal tissue at the present stage includes four types of tissues, such as gingiva, tooth root cement, alveolar bone and connective tissue fibers, which ensure the interconnection of these structures with each other. Of the entire complex of periodontal tissues, gingiva is the only structure that is available for direct visual examination and examination directly at a clinical admission. The gingiva is in contact with a variety of stimuli and, therefore, its morphology incorporates an important function of a barrier against pathogenic factors [1].

According to morphological studies, gingiva consists of a stratified squamous keratinizing epithelium and its proper plate. Epithelial cells are resident cells on the surface of the mucous membrane of the oral cavity as a whole, which are not capable of chemotaxis, but, starting their

life cycle in the basal layer, they gradually move as differentiation proceeds, through the spinous and granular layers, into the keratinized layer, where they are peeled off and removed from oral cavity [2]. Professor I.A. Bykova determined the quantitative parameters of each of the layers of epithelial cells in smears – imprints from the surface of the gingiva in case of norm which can be characterized by a certain standard of the quality of barrier properties [3]. In addition, the morphometric characteristics of the cells in each layer have their own characteristics depending on the degree of maturity and functional activity.

Physiological cooperation of epithelial cells with indigenous microflora of the oral cavity is capable of inactivating and removing pathogenic bacteria without inclusion of immunity mechanisms, which indicates a variety of functional activity of these cells in normal

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conditions. When you start the reactions of nonspecific and specific immunity, epithelial cells are actively involved in the initiation and stabilization of the inflammatory process in the periodontal tissue, and are able to perform the functions of antigen-presenting cells, which enables to consider them far beyond just a mechanical barrier [4].

One of the risk factors contributing to the development of periodontal pathology is somatic pathology and, in particular, coronary heart disease (CHD) [5].

Coronary heart disease ranks first in WHO statistics in terms of morbidity and early mortality among the working population [6]. Heart failure formed in the pathogenesis of CHD leads to impairment of regional hemodynamics in the body as a whole and in periodontal tissues in particular. Decrease in linear and volumetric velocity characteristics of blood flow in the microvasculature of periodontal tissue for ischemic heart disease, according to several studies, will lead to hypoxia, changes in oxygen balance and decrease in energy substrates to the gingival epithelial layer. Such features of the trophism in the periodontal disease with ischemic heart disease can lead to an imbalance in the process of gingival epithelial cell differentiation, changes in their morphometric parameters and a quantitative increase in cells with manifestations of cytopathology [7].

Rather simple, non-invasive and informative methods of exfoliative cytology allow us to

Material and methods

The study involved 71 patients with a verified diagnosis of coronary heart disease receiving basic therapy (verification according to the recommendations of the European Society of Cardiology based on the clinic, stress tests, Holter monitoring, ECG and coronary angiography). The control group consists of 20 somatically healthy patients, representative by age and sex.

All patients underwent cytological examination on scrapings and biopsies from the surface of the epithelium of the attached gingiva. Cytological and histological samples were stained with hematoxylin-eosin, azure-eosin and Papanicolau and viewed on a Micros microscope (Austria). In order to obtain photographs of the cells, a CAM-2800 digital video camera was used with light microscopy (objective $\times 40$, eyepiece $\times 10$).

Statistical processing was carried out using non-parametric methods, since, according to the Kolmogorov–Smirnov criterion, the law of data distribution did not correspond to the normal one. The median and interquartile range were calculated, and the Mann–Whitney test was used to compare the quantitative parameters.

Study results

A cytological study of scrapings from the surface of the attached gingiva to determine cell anomalies of epithelial cells showed that such cytopathology as karyorrhexis, karyolysis and vacuolization of the cytoplasm occurred significantly more often in the group of patients with CHD compared with the control one (*table 1*).

Table 1. Incidence of cell epithelial cellular abnormalities, Me [Q1÷Q3]

Parameter	Group of the patients with CHD		Control	
	Me	Q1÷Q3	Me	Q1÷Q3
Micronuclei	2,00	[2,00÷3,00]	2,00	[1,25÷3,00]
Two nuclei	3,00	[2,00÷3,00]	2,00	[2,00÷3,00]
Karyorrhexis	6,00	[5,00÷7,00] p=0,001	4,00	[4,00÷5,00]
Karyolysis	33,00	[29,00÷38,00] p=0,001	20,50	[18,00÷24,00]
Vacuolization	16,00	[14,00÷19,00] p=0,001	9,00	[7,25÷10,75]

Note. p – level of significance vs control.

estimate the morphometric parameters and cellular abnormalities of gingival epithelial cells that can occur in CHD.

Concerning the purpose of our study was to study the manifestations of cell pathology and changes in the morphometric parameters of gingival epithelial cells in patients with coronary heart disease.

Karyorrhexis is the process of disintegration of the nucleus into individual homogeneous particles, limited by karyolemma, which, after its destruction, enter the cytoplasm and undergo lysis (*fig. 1*).

During karyolysis, cells are observed both with a complete absence of the nucleus and with the remnants of degraded karyolemma. We associate

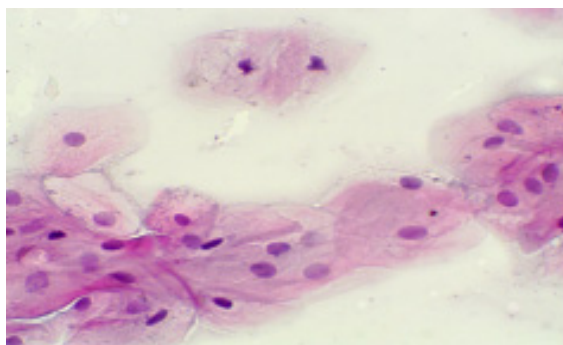


Fig. 1. Microphotography of a scraping cytogram from the attached part of the gingiva of patient K. with a diagnosis of CHD. The accumulation of epithelial cells with signs of karyorrhexis is determined without disturbing the karyolemma, Pap smears, $\times 400$

an increase in the number of cells with the indicated cytopathology with the existing chronic inflammatory process on the background of CHD.

When comparing the data in the table, it is determined that the cells with abnormalities in the form of karyorrhexis and karyolysis in the group with CHD significantly exceeded the control parameters by 1.5 and 1.6 times, respectively. The incidence of epithelial cells with vacuolization of the cytoplasm also had a rate of 1.7 in the presence of background pathology in the form of CHD.

In the histological study of the mucous membrane of the gums of patients with CHD, attention was paid to the almost universal worsening of the multilayer flat epithelium and the phenomena of parakeratosis. Stratification of the layers has been broken. Epithelial cells are found everywhere with the phenomena of protein parenchymatous dystrophy. Permanent morphological companion of the above-described pathomorphological changes is acanthosis (*fig. 2*).

In some cases, it is possible to state the presence of dysplasia phenomena, which manifests itself as a violation of stratification of layers, an increase in the nuclear-cytoplasmic index, hyperchromicity of nuclei and the presence of unit mitoses. These changes sometimes simulate the breakthrough of the basement membrane and the presence of invasive growth (*fig. 3*).

In the sclerotized subepithelial basis is determined in varying degrees of severity of lymphocytic infiltration. In some cases, it was limited to minor diffuse focuses of inflammation, and in some cases, the degree of inflammatory

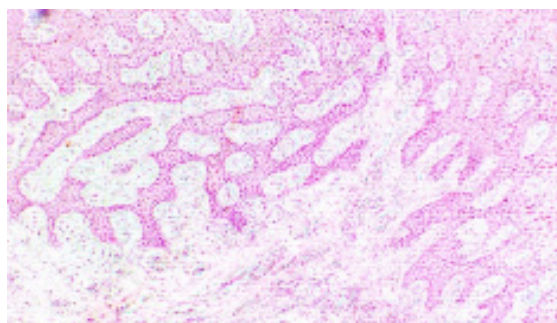


Fig. 2. Expressed thickening of multilayered flat epithelium of gum with acanthosis. Acanthous grafts are anastomosed with each other, forming a dense network in the sclerotized subepithelial basis. Coloring with hematoxylin and eosin, $\times 100$

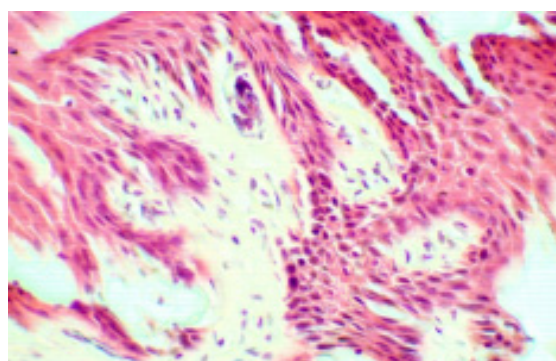


Fig. 3. Apical departments of acanthous lobes with signs of laceration violation. Cells of basal layer with hyperchromic nuclei. Some epithelial cells with phenomena of hydropic dystrophy. The absence of a clear boundary between the basal layer of the epithelium and the connective tissue basis of the gum. Coloring with hematoxylin and eosin, $\times 400$

process was expressed so that among the dense lymphocytic infiltrate with the admixture of leukocytes signs of formation of lymphoid follicles were observed (*fig. 4*).

Analysis of scrapings from a group of patients with ischemic heart disease showed different digital values of the degree of differentiation in the epithelial layer in comparison with data in somatically healthy ones. A significant increase in the number of superficial and keratinizing cells (1.9 and 1.13 times respectively), in our opinion, may indicate increased exfoliative processes in the gingiva in patients with ischemic heart disease. It is possible to consider it as a compensatory reaction aimed at maintaining barrier properties in the conditions of reduced level of microcirculation in periodontal tissues in CHD. At the same time,

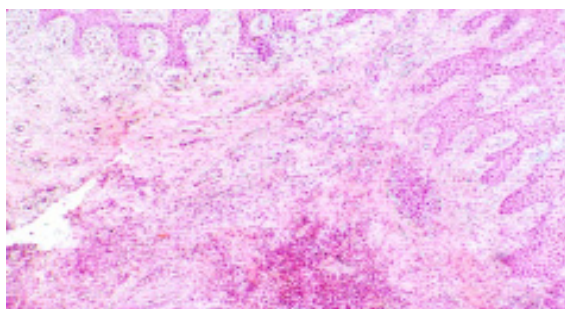


Fig. 4. Lymphohistiocytic infiltration of the mucous membrane of a multilayered flat epithelium with the formation of lymphoid follicles is expressed. Coloring with hematoxylin and eosin, $\times 100$

the cells of the intermediate type (the main layer of cells) were found to be significantly 59.0 ($p=0.001$) more often in the scrapings of the healthy group.

Comparing the morphometric study of the nucleus and the cell as a whole, there were also significant differences in the data between the groups (table 2).

Such information may indicate an increase in the exfoliation process and the appearance in the scrapings of cells from the deeper layers of the

Conclusions

Thus, in patients with cardiopathology, epithelial cells with such manifestations as karyorrhexis, karyolysis, vacuolization, which are direct participants of the inflammatory process in the periodontal disease, are significantly more common, which is confirmed by literature data and the presented scientific research. Such a risk factor as CHD helps to reduce the level of microcirculation in the periodontal tissue and determines a significant increase in epithelial cells with manifestations of cytopathology, reducing their effector potential and barrier properties. Also, changes in the nuclear-cytoplasmic ratio are observed in these patients. Changes in the quantitative data of differentiation of epithelial cells under conditions of energy deficiency against decrease in the level of microcirculation are manifested by an increase in exfoliation of cells of the surface and keratinizing layers, which may indicate compensatory capabilities aimed at preserving the barrier properties of the gingiva to prevent invasion of various periodontal pathogens not only deep into the periodontium, but also into the internal body environment.

Table 2. Morphometric parameters of epithelial cells of patients of the studied groups, Me [Q1÷Q3]

Parameter	CHD (n=71)	Control (n=20)	p
Pn, μm	44,098 [40,772÷46,148]	39,085 [37,100÷42,213]	0,001
Pc, μm	214,380 [196,776÷224,602]	220,395 [209,548÷238,980]	0,037
Pn / Pc	0,210 [0,202÷0,224]	0,170 [0,160÷0,180]	0,001
An, μm^2	106,760 [93,514÷121,188]	90,205 [78,820÷103,283]	0,001
Ac, μm^2	2821,426 [2316,256÷3278,850]	3062,905 [2682,123÷3593,725]	0,009
Act, μm^2	2718,006 [2193,080÷3183,190]	2963,270 [2601,068÷3479,565]	0,006
An / Act	0,042 [0,038÷0,046]	0,030 [0,028÷0,032]	0,001

epithelial layer, which have a larger nucleus in relation to the cytoplasm. Distinctions in the nuclear-cytoplasmic ratio between groups can lead to impaired differentiation of epithelial cells in the structure of the cell layer caused by a state of energy deficiency against the decrease in the level of microcirculation in periodontal disease with CHD.

Perspectives of the study

Obtained data necessitate further studies of the etiopathogenesis of these changes in order to develop timely medical care for periodontal diseases in patients with ischemic heart disease.

Conflict of interest

The authors declare no conflict of interest.

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Н.Ю. Ємельянова**ЦИТОЛОГІЧНІ Й МОРФОМЕТРИЧНІ ОСОБЛИВОСТІ КЛІТИН ЯСЕН ПРИ ІШЕМІЧНІЙ ХВОРОБІ СЕРЦЯ**

Захворювання тканин пародонта мають мультифакторну природу і не тільки залежать від місцевих етіологічних причин, а й можуть бути наслідком соматичної патології. При запуску патологічних змін епітеліоцити ясен здатні виконувати функції антигенпрезентуючих клітин. Особливий інтерес викликає ішемічна хвороба серця, яка може призводити до дисбалансу в процесі диференціювання епітеліоцитів ясен, змін їхніх морфометричних показників і кількісного збільшення клітин з проявами цитопатології. У зв'язку з цим вивчено прояви клітинної патології і зміни показників морфометрії епітеліоцитів ясен у хворих на ішемічну хворобу серця. Обстежено 71 пацієнта з ішемічною хворо-

бою серця і 20 соматично здорових пацієнтів. Проводили цитологічне дослідження на зішкрябах і біопсіях з поверхні епітелію прикріплених ясен. Доведено, що в пацієнтів з ішемічною хворобою серця статистично частіше виявляються зміни епітеліоцитів ясен з ознаками ядерної патології і зміни ядерно-цитоплазматичного співвідношення, ніж у соматично здорових обстежених.

Ключові слова: ішемічна хвороба серця, пародонт, цитопатології, морфометрія, епітеліоцит.

Н.Ю. Емельянова

ЦИТОЛОГИЧЕСКИЕ И MORFOMETРИЧЕСКИЕ ОСОБЕННОСТИ КЛЕТОК ДЕСНЫ ПРИ ИШЕМИЧЕСКОЙ БОЛЕЗНИ СЕРДЦА

Заболевания тканей пародонта имеют мультифакторную природу и не только зависят от местных этиологических причин, но и могут быть следствием соматической патологии. При запуске патологических изменений эпителиоциты десны способны выполнять функции антигенпрезентирующих клеток. Особый интерес вызывает ишемическая болезнь сердца, которая может приводить к дисбалансу в процессе дифференцировки эпителиоцитов десны, изменениям их морфометрических показателей и количественному увеличению клеток с проявлениями цитопатологии. В связи с этим изучены проявления клеточной патологии и изменения показателей морфометрии эпителиоцитов десны у больных ишемической болезнью сердца. Обследован 71 пациент с ишемической болезнью сердца и 20 соматически здоровых пациентов. Проводили цитологическое исследование на соскобах и биопсиях с поверхности эпителия прикрепленной десны. Доказано, что у пациентов с ишемической болезнью сердца статистически чаще обнаруживаются изменения эпителиоцитов десны с признаками ядерной патологии и изменения ядерно-цитоплазматического соотношения, чем у соматически здоровых обследованных.

Ключевые слова: ишемическая болезнь сердца, пародонт, цитопатология, морфометрия, эпителиоцит.

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