9. Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. The global prevalence of dementia: a systematic review and metaanalysis. Alzheimers Dement. 2013; 9: 63–75
10. Vinik AI, Park TS, Stansberry KB, Pittenger GL. Diabetic neuropathies. Diabetologia. 2000; 43 (8): 957–973. DOI: 10.1007/s001250051477
11. Wagner R, Heni M, Tabák AG, Machann J, Schick F, Randrianarisoa E, Hrabě de Angelis M, Birkenfeld AL, Stefan N, Peter A, Häring H-U, Fritsche A. Pathophysiology-based subphenotyping of individuals at elevated risk for type 2 diabetes. Nat Med. 2021; 27(1): 49–57. doi: 10.1038/s41591-020-1116-9.
12. Wodschow HZ, Jensen NJ, Nilsson MSDD, Rungby J. The effect of hyper- and hypoglycaemia on cognition and development of dementia for patients with diabetes mellitus type 2. Ugeskr Laeger. 2018; 180(51):V08180566.
13. Wu C-Y, Ouk M, Wong YY, Anita NZ, Edwards JD, Yang P, Shah BR, Herrmann N, Lanctôt KL, Kapral MK, MacIntosh BJ, Rabin JS, Black SE, Swardfager W. Relationships between memory decline and the use of metformin or DPP_4 inhibitors in people with type 2 diabetes with normal cognition or Alzheimer's disease, and the role APOE carrier status. Alzheimers Dement. 2020; 16(12): 1663–1673. doi: 10.1002/alz.12161.

Стаття надійшла24.12.2020 р.

DOI 10.26724/2079-8334-2021-4-78-208-213
UDC 616.233+616.24]-002-097:575.117

D.S. Ziablitsev, O.O. Dyadik[1], S.O. Khudoliy[2], V.I. Shepitko[3], S.V. Ziablitsev
Bogomolets National Medical University, Kyiv
[1]Shupik National University of Health of Ukraine, Kyiv
[2]Medical Center for Modern Addictology "MedicoMente", Kyiv
[3]Poltava State Medical University, Poltava

EXPRESSION OF ANGIOTENSIN-CONVERTING ENZYME-2 IN LUNG TISSUES IN EXPERIMENTAL BRONCHOPNEUMMONIA

e-mail: zsv1965@gmail.com

The purpose of this study was to establish the effect of acute pulmonary inflammation of non-viral origin on the expression of angiotensin-converting enzyme-2. Wistar rats (n=20) were introduced into the trachea of sterile nylon thread 2.5 cm long and 0.2 mm thick to a depth of 2.5 cm. Endotracheal injection of nylon thread led to formation of acute bronchopneumonia, which included the sequential development of: exudative and proliferative inflammation, peribronchial and alveolar abscesses, their organization and diffuse fibrosis of the lung parenchyma. It was shown that the exudative phase of acute inflammation was accompanied by inhibition of angiotensin-converting enzyme-2 expression in bronchial epitheliocytes, type II alveolocytes and vascular endothelium. During the transition of inflammation to the stage of proliferation and fibrosis, the expression of the enzyme was restored. The identified changes indicated the presence of regulatory factors that differ from the coronavirus action.

Key words: acute inflammation, fibrosis, endotracheal injection, immunohistochemistry

Д.С. Зябліцев, О.О. Дядик, С.О. Худолій, В.І. Шепитько, С.В. Зябліцев

ЕКСПРЕСІЯ АНГІОТЕНЗИН-ПЕРЕТВОРЮЮЧОГО ФЕРМЕНТУ-2 У ТКАНИНАХ ЛЕГЕНЬ ПРИ ЕКСПЕРИМЕНТАЛЬНІЙ БРОНХОПНЕВМОНІЇ

Метою дослідження було встановлення впливу гострого легеневого запалення не вірусного генезу на експресію ангіотензин-перетворюючого ферменту-2. Щурам лінії Вістар (n=20) було проведене введення у трахею стерильної капронової нитки довжиною 2,5 см та товщиною 0,2 мм на глибину 2,5 см. Ендотрахеальне введення капронової нитки призводило до формування гострої бронхопневмонії, яке включало послідовний розвиток: ексудативного і проліферативного запалення, перибронхіальних та альвеолярних абсцесів, їх організацію та дифузний фіброз паренхіми легень. Показано, що ексудативна фаза гострого запалення супроводжувалася пригніченням експресії ангіотензин-перетворюючого ферменту-2 у епітеліоцитах бронхів, альвеолоцитах II порядку та судинному ендотелії. При переході запалення у стадію проліферації та фіброзування експресія ферменту відновлювалася. Виявлені зміни вказували на наявність факторів регуляції, які відрізняються від дії коронавірусу.

Ключові слова: гостре запалення, фіброз, ендотрахеальне введення, імуногістохімія

The work is a fragment of the research project "Study of cell-molecular mechanisms of pharmacological influence on the reprogramming of the macrophages functional phenotype in wound regeneration on the background of hyperglycemia",state registration No. 0119U101219

Coronavirus disease 2019 (COVID-19) remains a serious threat to public health both today and in the future [15]. Coronavirus damages almost all systems and organs, but the lungs are most affected. Already at an early stage of the disease develops acute lung injury, which can lead to acute respiratory distress syndrome (ARDS) [13]. The exudative stage progresses to proliferative stage and pulmonary fibrosis [13].

After the first COVID epidemic in 2002, the functional receptor required for coronavirus to enter host cells was identified, they found angiotensin-converting enzyme-2 (ACE2) [8, 9]. In addition to lung

tissue, ACE2 is widely expressed in renal tubular cells, intestinal enterocytes, epithelium of the upper respiratory tract, myocardium, smooth muscle cells, neuroepithelium of the nasal sinuses, blood mononuclear cells and other cells, which causes numerous extrapulmonary symptoms of COVID-19 [4, 6]. Thus, on the one hand, ACE2 is a direct target for the invasion of SARS-CoV-2, and on the other hand, as an important component of the tissue renin-angiotensin system, has a number of protective effects in acute inflammation [8].

The purpose of the work was to study the expression of ACE2 in lung tissues in the dynamics of experimental acute aspiration bronchopneumonia.

Materials and methods. Reproduction of acute aspiration bronchopneumonia was performed according to the model [1]. To do this, Wistar rats (n=20) underwent surgery to insert a foreign body into the trachea. Using a conductor (injection needle), a sterile nylon thread 2.5 cm long and 0.2 mm thick was inserted 2.5 cm deep into the trachea. To do this, the animal was anesthetized with thiopental (50 mg/kg), made a small (up to 1 cm) skin incision in the projection of the trachea over the sternum along the midline, mobilized the trachea, pierced it with a conductor and injected nylon thread. The surgical wound was sutured. The control group included 5 sham operated animals.

The work was guided by the norms and principles of EU Directive 2010/63 on animal protection, the Declaration of Helsinki (2008) and the requirements of the Law of Ukraine "On Protection of Animals from Cruelty" (591759–VI of 15.12.2009). On days 7, 14, 21, and 28, 5 animals were removed from the experiment under thiopental anesthesia. Pieces of lung tissue from different areas were fixed in a 10 % solution of neutral buffered formalin (pH 7.4) for 24–36 hours. Serial histological sections 2–3 μm thick were made from paraffin blocks on a rotary microtome HM 325 (Thermo Shandon, England), which were then stained with hematoxylin and eosin. To determine the expression of ACE2 performed immunohistochemical study (IHCS) [6] with monoclonal antibodies against ACE2 (anti-ACE2; clone 4G5.1; Sigma-Aldrich MABN59, replaces MAB5676), manufactured by EMD Millipore Corporation; Temecula, CA US. Microscopic examination and photoarchiving were performed using light optical microscopes "ZEISS" (Germany) with a data processing system "Axio Imager" A2" additionally equipped with a digital camera "Olimpus C3030-ADU", software "Olimpus DP-Soft".

Results of the study and their discussion. After the operation, the animals developed shortness of breath, single rales were heard. Rectal temperature ranged from 37.6 to 37.8°C, respiratory rate – 72–102 per minute. On the 3-4th day, wet rales, frequent breathing (up to 120 per minute) and shallow, temperature ranged from 37.2 to 38.4°C. At the end of the 1st week of observation, cyanosis appeared, shallow breathing was irregular, with the active involvement of additional respiratory muscles, and severe wheezing and crepitation were heard. At the 2nd–4th week of observation, these manifestations progressed, breathing was hard, difficult, rales, crepitation were heard, and all animals had pronounced cyanosis. Sectional examination showed that the lungs were swollen, cyanotic, had fibrin layers and intratissue hemorrhage. After 3–4 weeks of follow-up to these manifestations were added fibrosis, carnification, the lungs were compacted, decreased in size.

Pathomorphological examination of lung tissues on day 7 in micropreparations showed fullness of blood vessels, including the microcirculatory tract, in terms of signs of microthrombosis, stasis, in some places – venules ectasia. Compensatory reactive changes of alveolocytes were observed segmentally, mainly due to a hyperplasia of type II epitheliocytes.

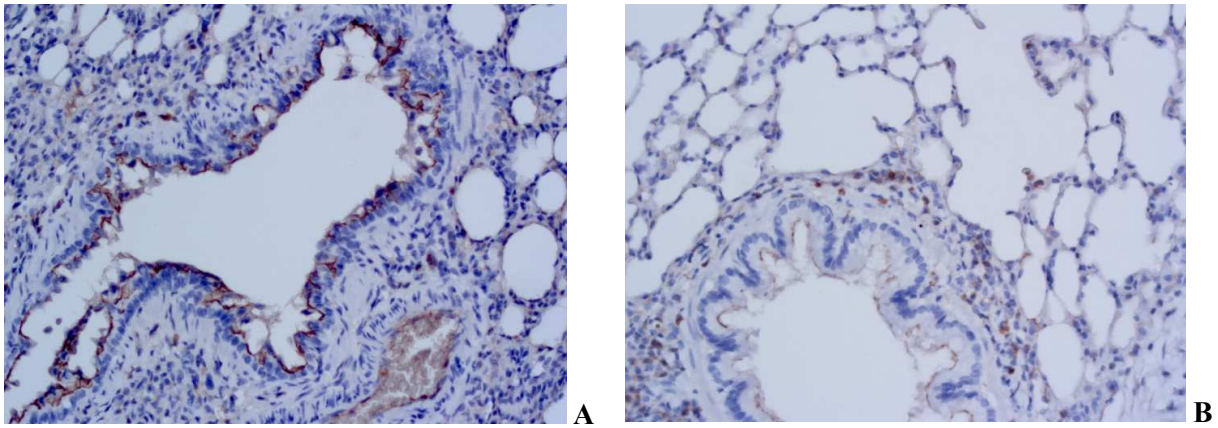

Fig. 1. Micropreparations of rat lungs. IHCS with a monoclonal antibody to ACE2. A – control; B – experimental aspiration pneumonia, 7th day. ×100 A – positive expression on the apical surface of the bronchial epithelium, positive expression of mononuclear cells in the interstitium and type II alveolocytes; B – reduced intensity of expression in the bronchial epithelium, single positive type II alveolocytes, positive expression in mononuclear cells of the interstitium.

IHCS with the marker anti-ACE2 in the structures of the lungs in the control group showed a positive expression of ACE2 (fig. 1A). Expressed expression was detected on the apical surface of the bronchial epithelium in the form of diffuse staining of the solid border. In the lung parenchyma and peribronchially positive expression was observed in part of type II alveolocytes, in part of monocytes, in the endothelium of vessels of various calibers.

On the 7th day of the inflammatory process, there was a significant decrease in the intensity of ACE2 expression in the bronchial epithelium, mainly with a weak positive reaction in single cells (fig. 1B).

It should be noted that the expression of ACE2 in type II alveolocytes disappeared, in some cells the weak expression of ACE2 was preserved. Instead, the expression of ACE2 in mononuclear cells in the interstitium increased significantly.

Pathological examination of lung tissue on day 14 revealed a violation of the organ histoarchitectonics due to the formation of pneumo- and bronchogenic acute abscesses. In the alveoli there was purulent exudate, reactive changes of alveolocytes of both I and II types in the form of hyperplasia. Along with this, the growth of young connective tissue was noted in some areas.

IHCS with the marker anti-ACE2 on the 14th day of observation showed a weakening compared with the control of ACE2 expression (fig. 2).

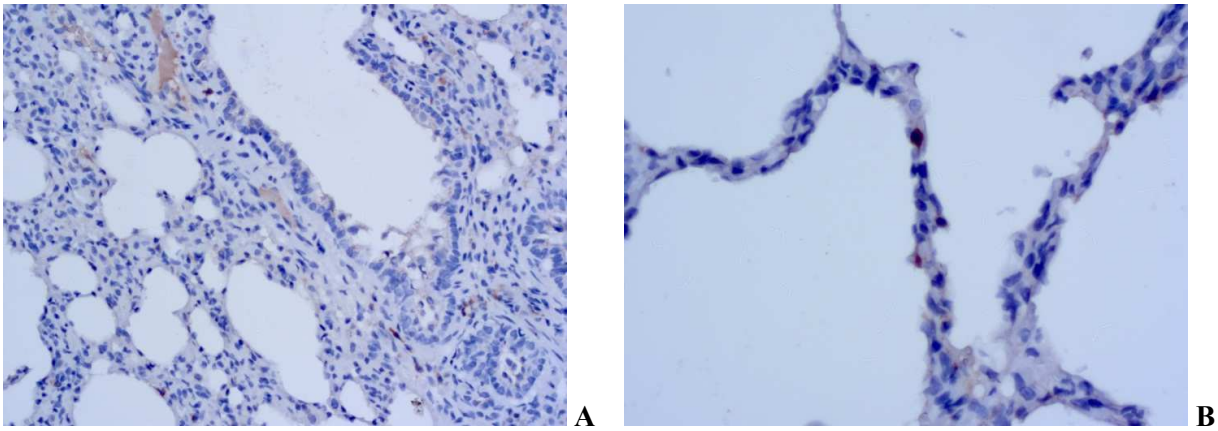

Fig. 2. Micropreparations of rat lungs. IHCS with a monoclonal antibody to ACE2. Experimental aspiration pneumonia, 14th day. General decrease in expression with its preservation in single macrophages and individual type II epitheliocytes. A ×100; B ×400

Moreover, this attenuation was characteristic not only for bronchial epithelial cells, but also for interstitial macrophages, among which the expression was preserved in single large cells. Mostly weak expression was preserved in type II alveolocytes.

On day 21, the general histoarchitectonics of the organ was disturbed due to the formed pneumonogenic (bronchogenic) abscesses with initial signs of pneumonia organization. In the lung parenchyma the phenomenon of dystelectasis in the form of atelectatically altered areas (with complete overlap of alveolar lumens), interalveolar membranes swollen, infiltrated with lymphocytes, focal – monocytes and neutrophils; activation of fibroblasts in the form of a delicate fibrillar network was observed (fibrosis of the interalveolar septa). Signs of reactive changes of alveolocytes of types I and II, which manifested by hyperplasia and initial cell proliferation. The formation of a delicate fibrillar matrix perifocal to the abscess zones was noted peribronchially.

IHCS with the marker anti-ACE2 on the 21st day of observation, in general, showed a tendency to restore the intensity of ACE2 expression compared to previous terms (fig. 3).

Almost throughout the apical surface of the bronchial epithelium gave a positive expression of ACE2. In the interstitium, the number of positive monocytes was small; clusters of such cells were formed. ACE2 positive expression was not detected in areas of newly formed fibrous tissue. It was found that during this period the expressed expression was observed in the endothelium of vessels of different caliber. As in previous terms, ACE2 positive expression was observed in single type II alveolocytes.

After 28 days, the general histoarchitectonics of the lung was disturbed due to signs of pneumonia, mainly with parenchymal fibrosis, sclerosis and vascular hyalinosis. Uneven plethora of microcirculatory vessels was noted. Lung parenchyma with the phenomena of dystelectasis with atelectatically altered areas, with areas of complete overlap of alveolar lumens; interalveolar membranes are swollen, infiltrated with lymphocytes, a small number of neutrophilic leukocytes, but infiltration is less dense than after 14 and 21 days. In alveoli insignificant serous-purulent exudate, fibrin threads; emphysematically dilated alveoli are smaller in area compared to previous periods. Zones of abscesses were practically not defined.

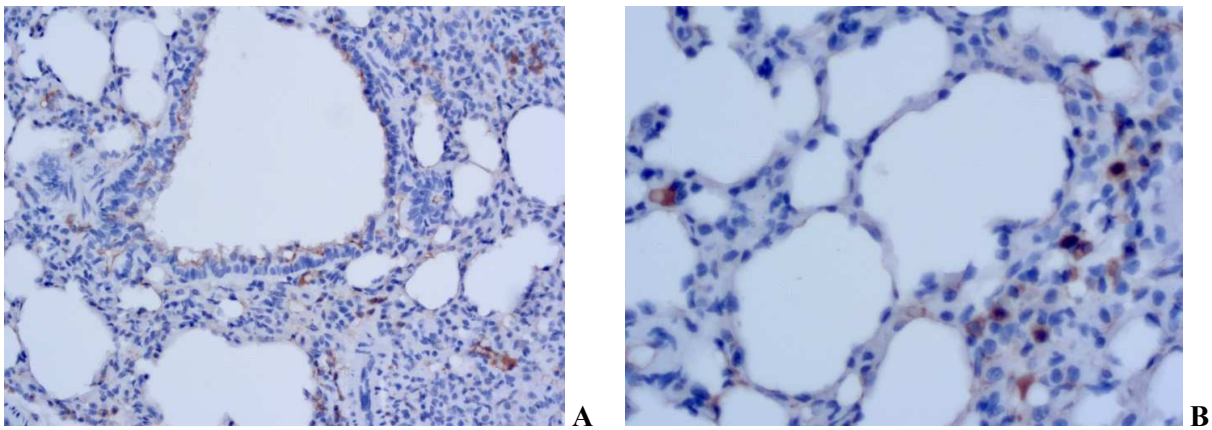

Fig. 3. Micropreparations of rat lungs. IHCS with a monoclonal antibody to ACE2. Experimental aspiration pneumonia, 21st day. Restoration of bronchial epithelium expression, accumulation of immunopositive monocytes, macrophages in areas of cellular infiltrates outside the newly formed fibrous tissue; positive staining of vascular endothelium, single positive type II alveolocytes. A ×100; B ×200

IHCS with the marker anti-ACE2 on the 28th day of observation showed a restoration of the intensity of ACE2 expression in comparison with the control and previous terms of the study (fig. 4).

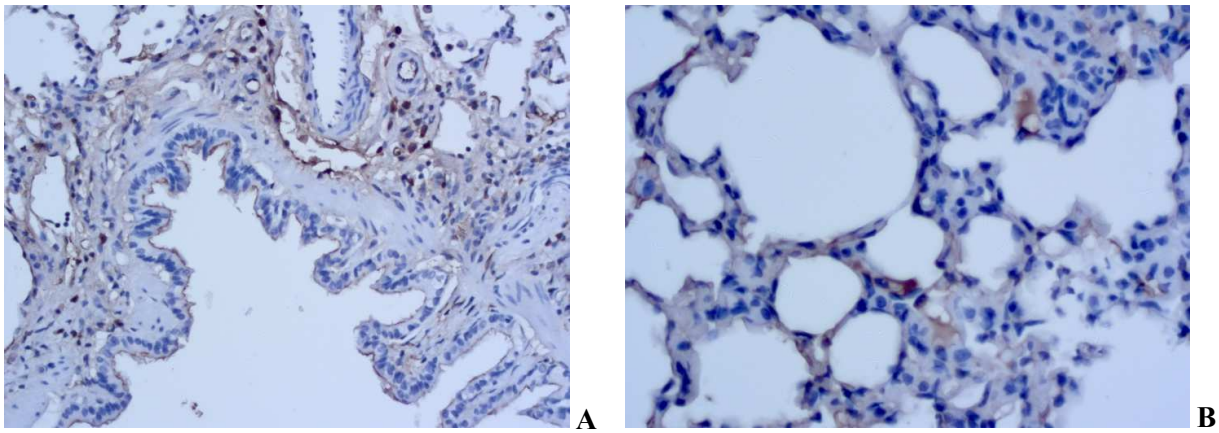

Fig. 4. Micropreparations of rat lungs. IHCS with a monoclonal antibody to ACE2. Experimental aspiration pneumonia, 28th day. Intense diffuse expression on the apical surface of the bronchial epithelium, a large number of large positive cells in the interstitium, in the interalveolar septa, positive staining of vascular endothelium, positive type II alveolocytes. A ×100; B ×200

The bronchial epithelium throughout the apical surface had an intense expression in the form of an almost continuous border. In the interstitium there were a large number of mononuclear and macrophage cells with intense expression. The expressed expression in endotheliocytes of vessels of various caliber is noted. The vast majority of type II alveolocytes were intensely expressed.

Clinical observations of animals have shown the gradual development of pulmonary symptoms such as shortness of breath, progressive wheezing, crepitation, and cyanosis. Small species of rodents (hamsters, mice), wild types of which are susceptible to SARS-CoV-2, also have respiratory symptoms, including pneumonia, however, there is no hypoxemic respiratory failure, extrapulmonary dysfunction and mortality [5]. Microscopic picture of the lungs in the experimental model showed the development of acute bronchopulmonary inflammation during the first week, the formation of peribronchial and alveolar abscesses in the second week with the onset of bronchopneumonia with the organization of abscesses in the third week and the development of diffusional parenchyma fibrosis and vascular fibrosis with hyalinosis in the fourth weeks.

Our studies have shown the presence of dystrophic changes in the alveolar epithelium, active lymphoid infiltration and vascular disorders of the microcirculatory vessels of the interalveolar septa. Therefore, we tend to believe that the model of experimental aspiration pneumonia with the introduction of nylon thread reproduces the mild course of pneumonia in patients with COVID-19 [2]. On the other hand, the experimental model used was quite effective in modeling pulmonary fibrosis.

The main source of immunospecific ACE2 staining in the animals' lungs ended up the apical surface of the bronchial epithelium, where it had the appearance of a solid border, type II alveolocytes, single monocytes and vascular endothelium. Similar results were obtained in rats in other studies: type II alveolocytes and endothelium were stained quite intensely in peripheral alveoli [2, 4]. In humans, ACE2 expression was highest in the regions of the sinus nasal cavity and pulmonary alveoli, sites of putative viral

transmission [7, 10]. In the lung parenchyma, the ACE2 protein was detected on the apical surface of a small number of type II alveolar epithelial cells. The apical distribution of ACE2 expression in the airway epithelium has been confirmed in other studies, it is this feature of ACE2 expression that promotes the penetration and reproduction of the virus [4, 6].

In our studies, the expression of ACE2 on days 7 and 14 was reduced and persisted in single cells of the bronchial epithelium and type II alveolocytes. This was consistent with experimental data from an animal model of acute pulmonary injury [5].

The expressed diffuse endothelium damage at COVID-19 is noted and in other works [3, 7], that defines thrombogenicity of this disease. By the way, the model of aspiration pneumonia allows obtaining a pronounced endothelial dysfunction with diffuse thrombosis. A certain role in this pathological process may belong to ACE2 insufficiency and the low formation of angiotensin 1–7 with a predominance of angiotensin II prothrombogenic effects [3].

In our studies, there was an increase in the expression of ACE2 in mononuclear cells in the pulmonary interstitium on the 7th day, followed by a decrease. The presence of ACE2-immunopositive staining of interstitial immune cells (T-lymphocytes, macrophages, neutrophils and even fibroblasts) has been noted in other studies [4, 6, 10].

The inhibition of ACE2 expression is associated with the direct action of S-protein and the virus itself [9, 12]. Our data directly showed that even in the absence of viral infection, the expression of ACE2 in the acute phase of inflammation is reduced, which is an additional factor in exacerbating inflammatory damage. Interferon I may act as the most likely regulator of ACE2 expression, which mediates the innate immune response against viral infection by directly inhibiting virus replication [12]. ACE2 gene expression is stimulated by human interferon, both *in vitro* using airway epithelial cells and *in vivo*: SARS-CoV-2 can inhibit the interferon regulation of ACE2 to enhance infection. Therefore, the decrease in ACE2 content in COVID-19, in addition to the direct action of the virus, can occur due to the suppression of interferon and reduced expression of ACE2 [14].

On the 21st–28th day, we determined the restoration of ACE2 expression compared to previous dates. In our opinion, such results were explained, on the one hand, by the attenuation of acute manifestations of inflammation with its transition to the stage of proliferation, and on the other – by the progression of hypoxia. ACE2 mRNA and protein expression have been shown to be induced by hypoxia in small human airway epithelial cells, and hypoxia-induced increase in ACE2 expression in type II alveolocytes was observed in patients with long-term COVID-19 [11].

Thus, our study showed the relationship between acute bronchopulmonary inflammation during the development of experimental aspiration pneumonia with the expression of ACE2. It was shown that the exudative phase of acute inflammation was accompanied by inhibition of ACE2 expression. During the transition of inflammation to the stage of proliferation and fibrosis, the expression of ACE2 was restored.

Conclusions

1. The introduction of a nylon thread into the trachea allowed to simulate acute bronchopneumonia with the gradual development of exudative and proliferative inflammation; formation of peribronchial and alveolar abscesses with their organization and development of diffuse parenchymal fibrosis and vascular hyalinosis.

2. The exudative phase of acute inflammation was accompanied by inhibition of ACE2 expression in bronchial epitheliocytes, type II alveolocytes, and vascular endothelium. During the transition of inflammation to the stage of proliferation and fibrosis, the expression of ACE2 was restored.

References

1. Kubyshkin AV, Fomochkina II. Elastoliticheskaya aktivnost bronchoalveolyarnogo lavaya pri modelirovanii vospalitelnogo protsessa v legkikh. Ukr. Biohim. Zhurn. 2008;80(1):89-95. [in Russian]

2. Ackermann M, Verleden SE, Kuehnel M, Haverich A, Welte T, Laenger F, et al. Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19. N Engl J Med. 2020 Jul 9;383(2):120–128. doi: 10.1056/NEJMoa2015432.

3. Cipolloni L, Sessa F, Bertozzi G, Baldari B, Cantatore S, Testi R, et al. Preliminary Post-Mortem COVID-19 Evidence of Endothelial Injury and Factor VIII Hyperexpression. Diagnostics (Basel). 2020 Aug 9;10(8):575. doi: 10.3390/diagnostics10080575.

4. Descamps G, Verset L, Trelcat A, Hopkins C, Lechien JR, Journe F, Saussez S. ACE2 Protein Landscape in the Head and Neck Region: The Conundrum of SARS-CoV-2 Infection. Biology (Basel). 2020 Aug 18;9(8):235. doi: 10.3390/biology9080235.

5. Ehaideb SN, Abdullah ML, Abuyassin B, Bouchama A. Evidence of a wide gap between COVID-19 in humans and animal models: a systematic review. Critical care (London, England). 2020;24(1):594. doi: 10.1186/s13054-020-03304-8.

6. Hamming I, Timens W, Bulthuis MLC, Lely AT, Navis GJ, van Goor H. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. J. Pathol. 2004;203:631–637. doi: 10.1002/path.1570.

7. Hikmet F, Méar L, Edvinsson Å, Micke P, Uhlén M, Lindskog C. The protein expression profile of ACE2 in human tissues. Mol Syst Biol. 2020 Jul;16(7):e9610. doi: 10.15252/msb.20209610.

8. Lan J, Ge J, Yu J, Shan S, Zhou H, Fan S, et al. Structure of the SARS-CoV-2 spike receptor-binding domain bound to the

ACE2 receptor. Nature. 2020;581:215–220. doi: 10.1038/s41586-020-2180-5.
9. Liu MY, Zheng B, Zhang Y, Li JP. Role and mechanism of angiotensin-converting enzyme 2 in acute lung injury in coronavirus disease 2019. Chronic Dis Transl Med. 2020 Jun;6(2):98–105. doi: 10.1016/j.cdtm.2020.05.003.
10. Ortiz ME, Thurman A, Pezzulo AA, Leidinger MR, Klesney-Tait JA, Karp PH, et al. Heterogeneous expression of the SARS-Coronavirus-2 receptor ACE2 in the human respiratory tract. EBioMedicine. 2020 Oct;60:102976. doi: 10.1016/j.ebiom.2020.102976.
11. Sturrock A, Zimmerman E, Helms M, Liou TG, Paine R 3rd. Hypoxia induces expression of angiotensin-converting enzyme II in alveolar epithelial cells: Implications for the pathogenesis of acute lung injury in COVID-19. Physiol Rep. 2021 May;9(9):e14854. doi: 10.14814/phy2.14854.
12. Sui Y, Li J, Venzon DJ, Berzofsky JA. SARS-CoV-2 Spike Protein Suppresses ACE2 and Type I Interferon Expression in Primary Cells From Macaque Lung Bronchoalveolar Lavage. Front Immunol. 2021 Jun 4;12:658428. doi: 10.3389/fimmu.2021.658428.
13. Suster S, Moran AC. Biopsy interpretation of the lung. 1st ed. Lippincott Williams & Wilkins, Wolters Kluwer; 2013. 417 p.
14. Vieira C, Nery L, Martins L, Jabour L, Dias R, Simões E Silva AC. Downregulation of Membrane-bound Angiotensin Converting Enzyme 2 (ACE2) Receptor has a Pivotal Role in COVID-19 Immunopathology. Curr Drug Targets. 2021;22(3):254–281. doi: 10.2174/1389450121666201020154033.
15. World Health Organization. Coronavirus disease (COVID-19) outbreak. Available on: https://www.who.int

Стаття надійшла 26.12.2020 р.

DOI 10.26724/2079-8334-2021-4-78-213-218
UDC 612.127.2:616.314–002.4+616.314.17–008.1(612.015.6)

V.S. Ivanov, O.V. Dienha, S.A. Shnaider, T.O. Pyndus[1], V.B. Pyndus[1], F.Y. Shchepanskyy[1]
SE "The Institute of stomatology and maxilla-facial surgery National academy of medical sciences of Ukraine", Odesa, [1]Lviv medical institute, Lviv

CORRECTION OF METABOLIC CHANGES OF TISSUES OF RATS ORAL CAVITY BY COMPLEX OF PREPARATIONS UNDER CONDITIONS OF INTRAUTERINE HYPOXIA AND CARIOGENIC DIET

e–mail: ivanov-dent@ukr.net

The research is dedicated to the study of the effect of the complex of preparations on the dental status and the state of the tissues of the oral cavity of rats under conditions of intrauterine hypoxia and cariogenic diet. The experiment was carried out on 35 white rats of both sexes: 29 female and 6 male rats. It was revealed caries-prophylactic effect and a decrease in the aggressiveness of the pathological process under the action of the complex in the conditions of intrauterine tissue hypoxia and cariogenic diet. The complex showed an anti-inflammatory effect in the oral mucosa. The levels of metabolic markers of pyruvate hypoxia in the liver and in the oral mucosa returned to normal state. The complex significantly improved the state of collagen and glycosaminoglycans in the parodontal bone tissue.

Key words: hypoxia, caries-prophylactic effect, metabolic markers, plant polyphenols, rats.

В.С. Іванов, О.В. Дєньга, С.А. Шнайдер, Т.О. Пиндус, В.Б. Пиндус, Ф.Й. Щепанський

КОРЕКЦІЯ МЕТАБОЛІЧНИХ ЗМІН ТКАНИН РОТОВОЇ ПОРОЖНИНИ ЩУРІВ КОМПЛЕКСОМ ПРЕПАРАТІВ В УМОВАХ ДІЇ ВНУТРІШНЬОУТРОБНОЇ ГІПОКСІЇ ТА КАРІЄСОГЕННОГО РАЦІОНУ

Дослідження присвячено вивченню впливу комплексу препаратів на стоматологічний статус і стан тканин ротової порожнини щурів в умовах дії внутрішньоутробної гіпоксії та карієсогенного раціону. Дослід проведено на 35 білих щурах обох статей: 29 самок і 6 самців. Було виявлено карієс-профілактичну дію і зниження агресивності патологічного процесу при впливу комплексу в умовах дії внутрішньоутробної тканинної гіпоксії і карієсогенного раціону. Комплекс проявив протизапальну дію в слизовій оболонці порожнини рота. Рівні метаболічних маркерів гіпоксії пірувату в печінці і в слизової оболонки порожнини рота нормалізувалися. Комплекс в кісткової тканини пародонту значно поліпшував стан колагену і глікозаміногліканів.

Ключові слова: гіпоксія, карієс-профілактична дія, метаболічні маркери, рослинні поліфеноли, щури.

The work is a fragment of the research project "Influence of hypoxia on the processes of collagen formation and mineralization on models of dental pathology and correction of the obtained disorders", state registration No. 0118U006963.

Hypoxia is a state of oxygen starvation of the body as a whole and of individual organs and tissues, caused by various factors. To assess the patterns of development of metabolic changes in different forms of pathology, endogenous hypoxia is more important, which include tissue hypoxia. This type of hypoxia occurs due to impaired oxygen extraction by tissues from the flowing blood and the inability of cells to utilize oxygen [2].

The triggers for the development of tissue hypoxia are diverse and may be associated with various factors. In three parts of the respiratory chain, respiration is associated with oxidative phosphorylation and